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Hasegawa

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(54) **IMAGE HEATING APPARATUS**

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(52) **U.S. Cl.**
CPC ***G03G 15/2017*** (2013.01); *G03G 2215/2019* (2013.01)

(58) **Field of Classification Search**
USPC 399/67
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,711,306	B2	5/2010	Kagawa	
8,838,002	B2 *	9/2014	Takahashi	399/330
2007/0189817	A1	8/2007	Kagawa	
2009/0092422	A1 *	4/2009	Kagawa	399/328
2009/0257767	A1 *	10/2009	Funabiki	399/68
2013/0209145	A1	8/2013	Hasegawa	
2014/0086647	A1	3/2014	Hasegawa	
2014/0093287	A1	4/2014	Hasegawa	
2014/0153947	A1	6/2014	Hasegawa	
2014/0153981	A1	6/2014	Hasegawa	

FOREIGN PATENT DOCUMENTS

JP	2004-198658	A	7/2004
JP	2004-198659	A	7/2004
JP	2007-212896	A	8/2007

OTHER PUBLICATIONS

U.S. Appl. No. 14/178,557 to Takuya Hasegawa, filed Feb. 12, 2014, Status: Pending.

* cited by examiner

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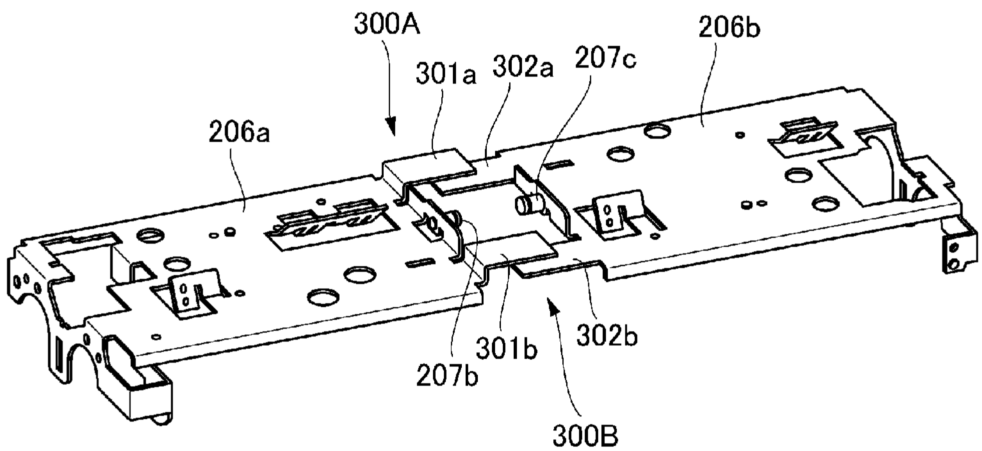
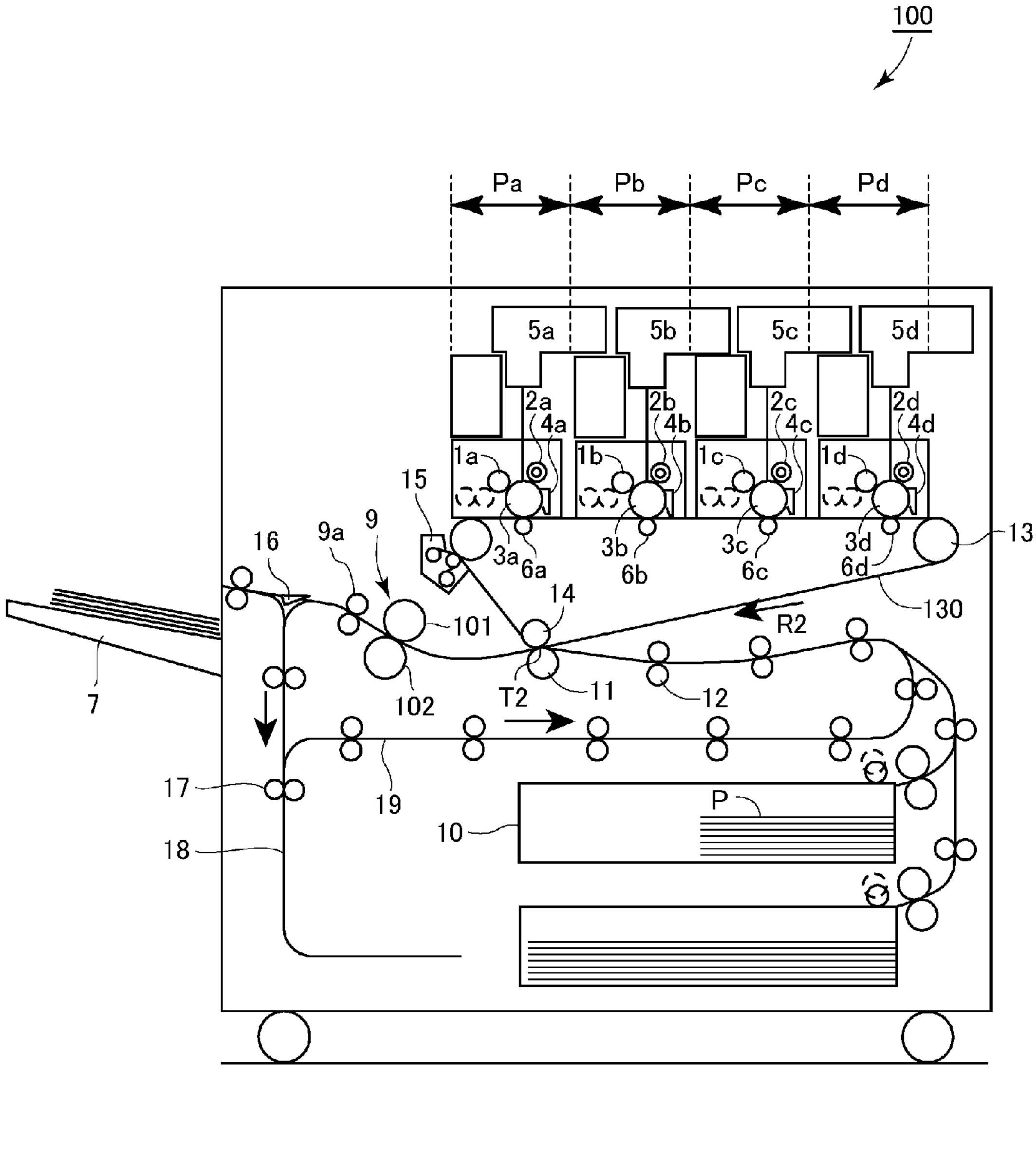
(57) **ABSTRACT**

An image heating apparatus includes: a rotating mechanism for rotating a belt unit in a direction for returning a belt into a predetermined zone; a displacing mechanism for permitting a first supporting member to be displaced in a direction for substantially equalizing forces, from the first supporting member, urging the belt toward a rotatable heating member at opposite end portions of the first supporting member with respect to a belt widthwise direction and to permit a second supporting member to be displaced in a direction for substantially equalizing forces, from the second supporting member, urging the belt toward the rotatable heating member at opposite end portions of the second supporting member; and a limiting mechanism for limiting the amount of the displacement permitted by the displacing mechanism within a predetermined amount.

22 Claims, 21 Drawing Sheets

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Pd
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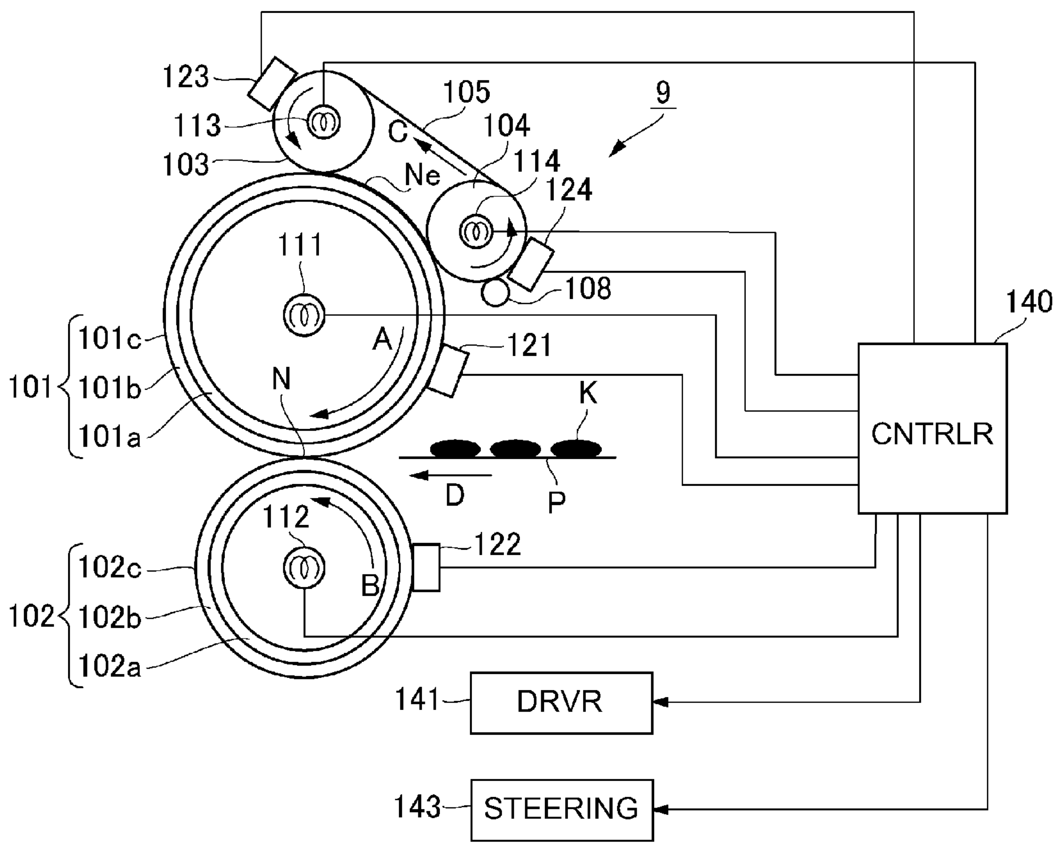
1a
1b
1c
1d
15
3a
6a
3b
6b
3c
6c
3d
6d
13
16
9a
9
14
130
R2
101
102
11
12
T2
7
17
19
18
10
P

Fig. 1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101b
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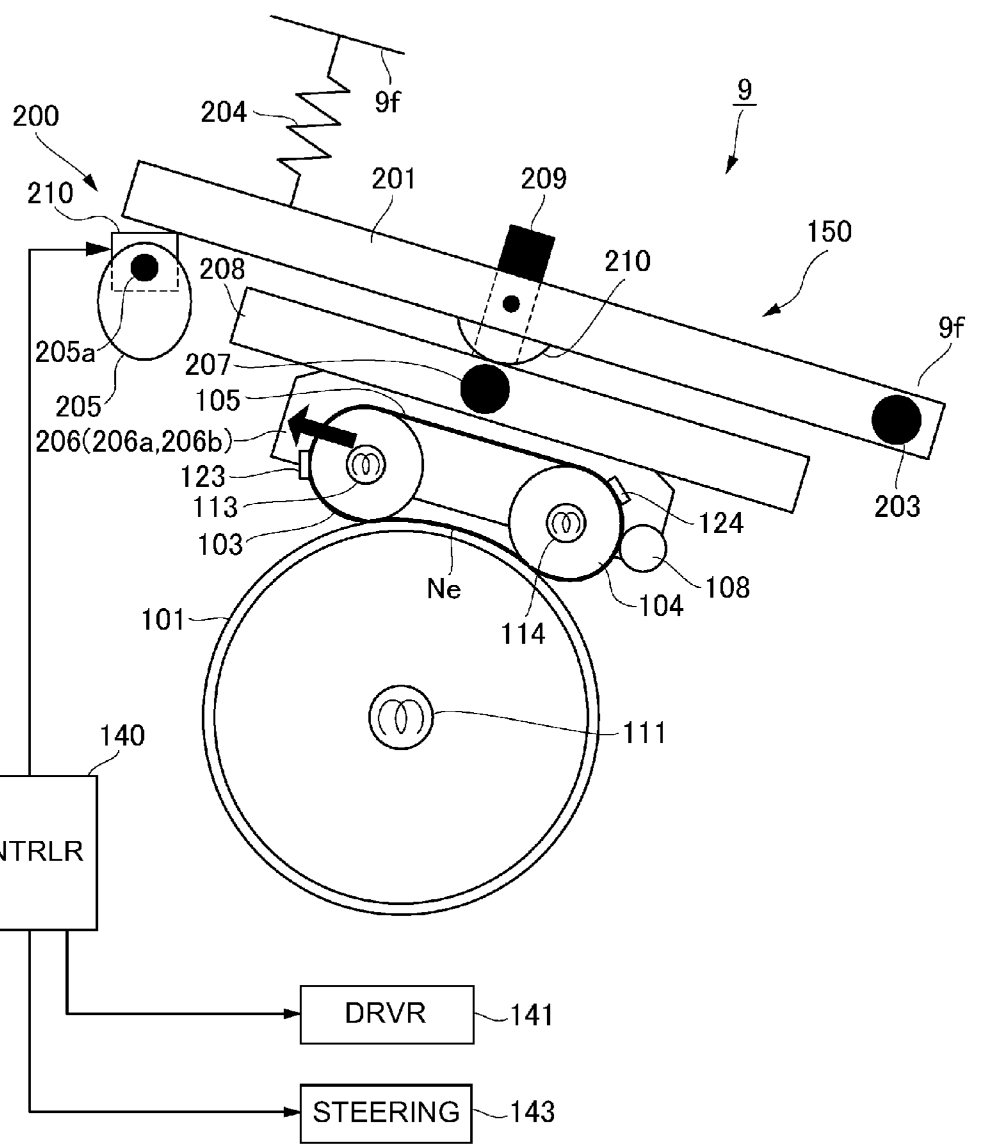
A
121
N
K
CNTRLR
D
P
112
122
102
102c
102b
102a
B
141
DRVR
143
STEERING

Fig. 2


9
9f
204
200
201
209
210
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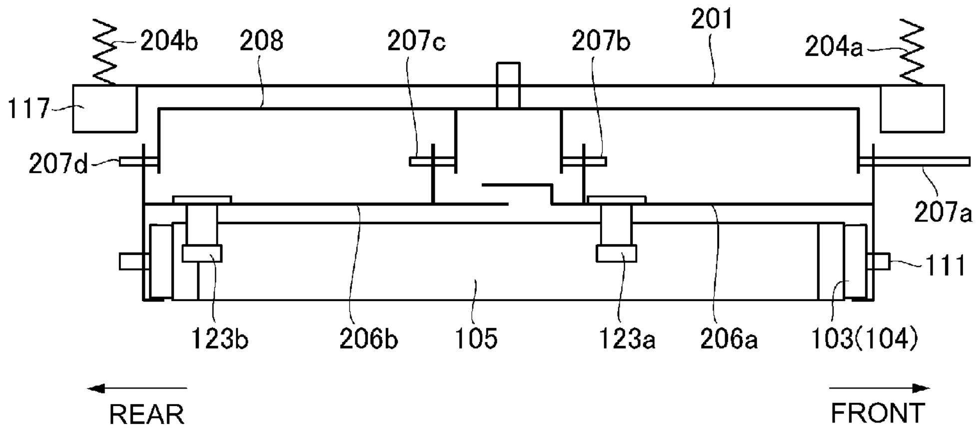
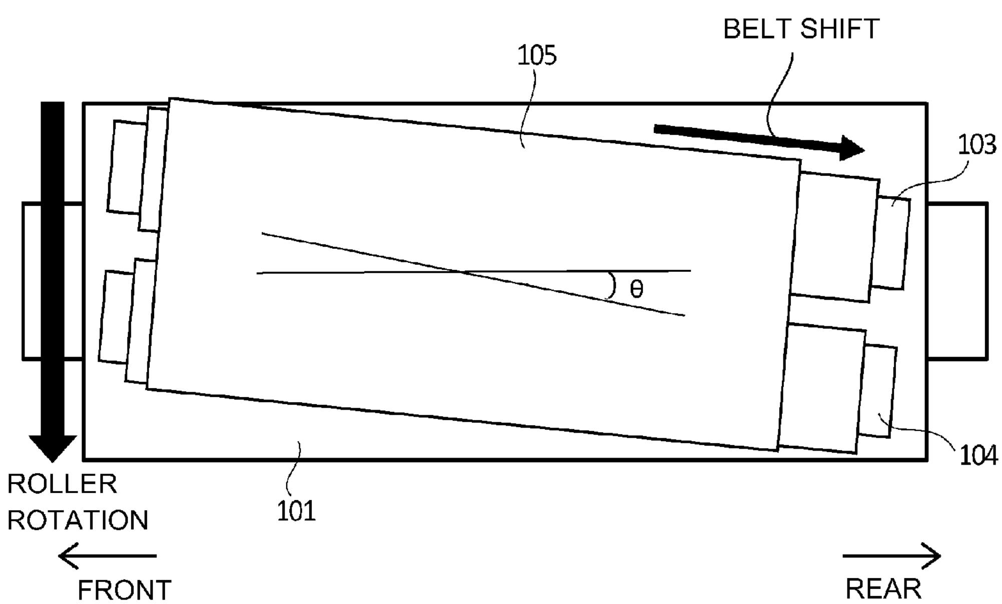
208
210
9f
205a
207
205
105
206(206a,206b)
123
113
103
124
203
108
Ne
104
101
114
111
140
CNTRLR
DRVR
141
STEERING
143

Fig. 3



204b
208
207c
207b
201
204a
117
207d
207a
111
123b
206b
105
123a
206a
103(104)
REAR
FRONT

Fig. 4



BELT SHIFT
105
103
θ
104
ROLLER ROTATION
101
FRONT
REAR

Fig. 5

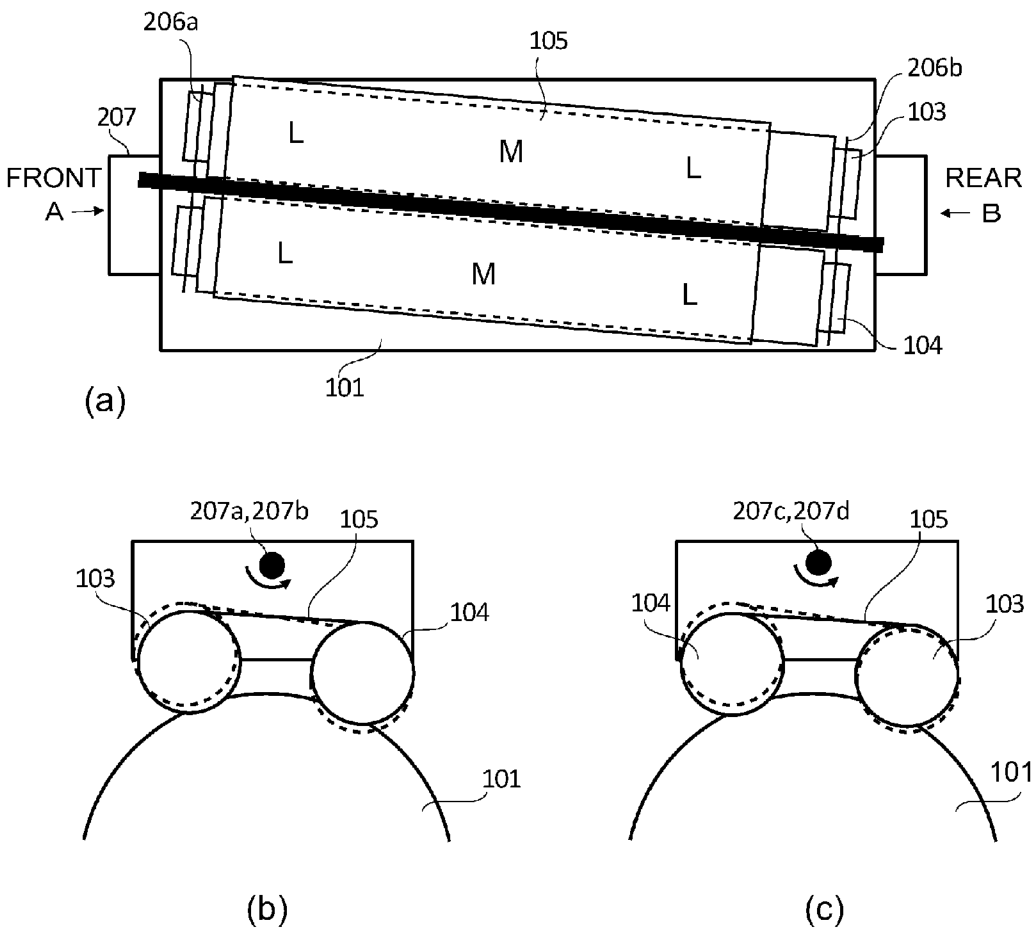
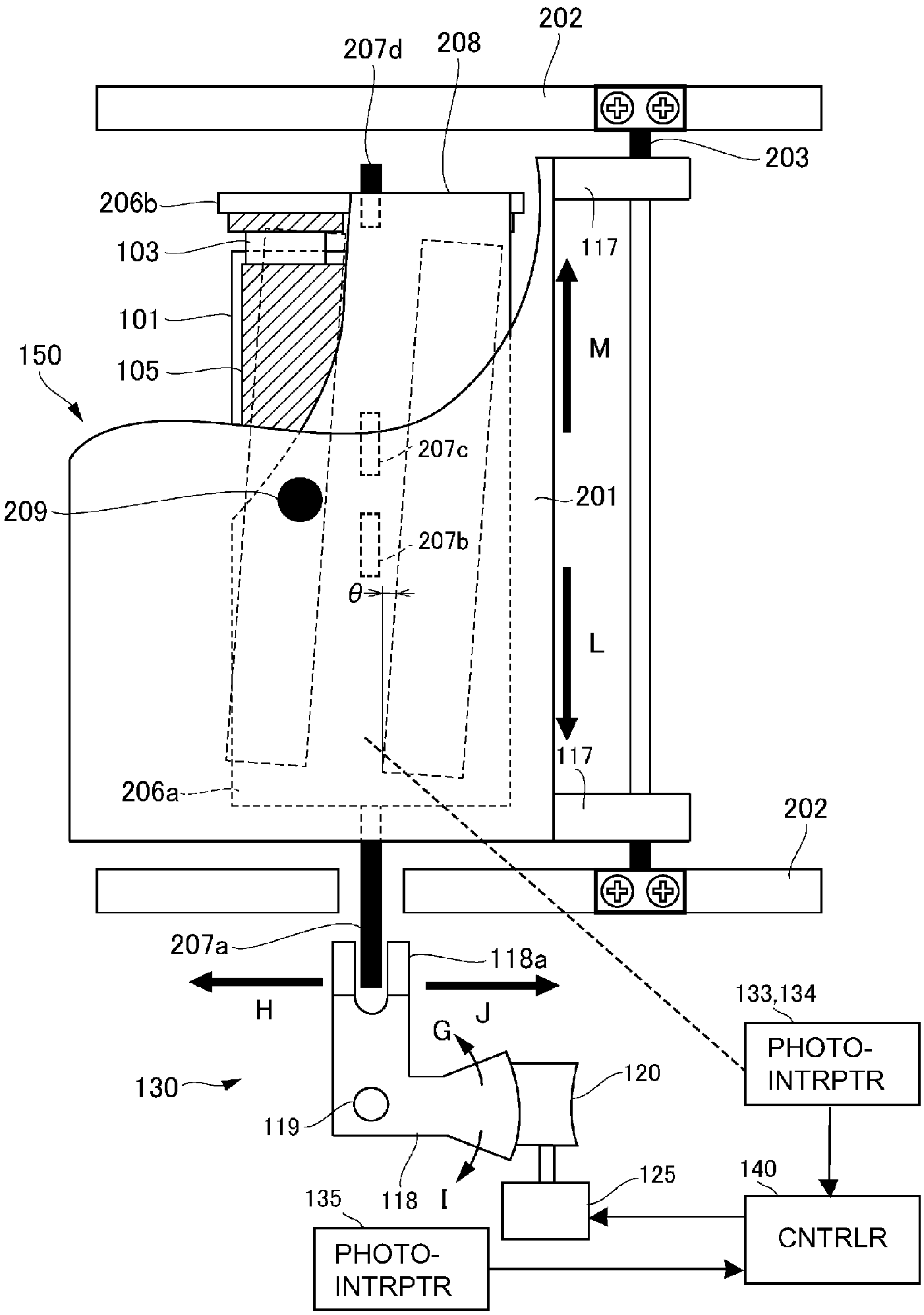
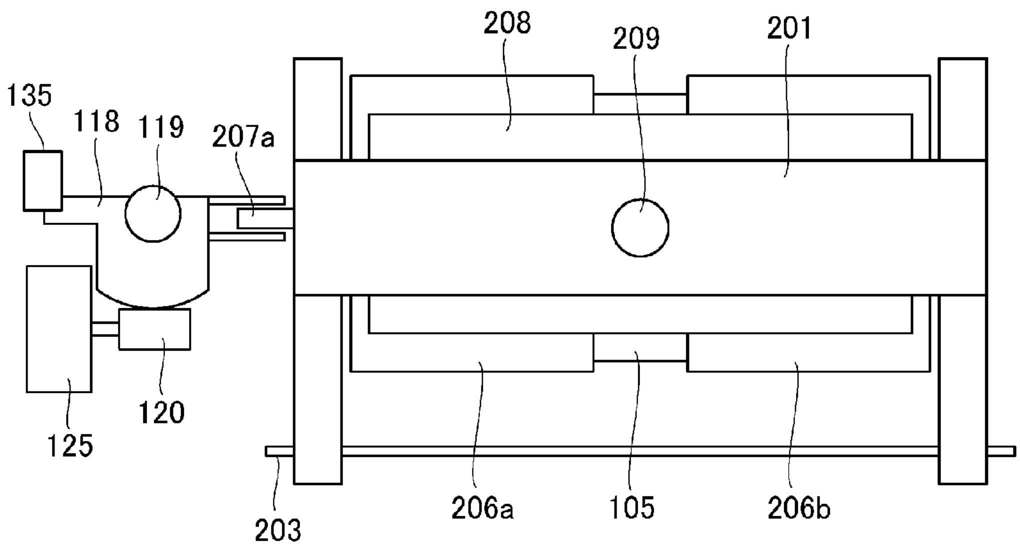

206a
105
206b
103
207
FRONT
A
L
M
L
REAR
B
L
M
L
104
101
(a)
207a,207b
105
103
104
101
(b)
207c,207d
105
104
103
101
(c)

Fig. 6



202
207d
208
203
206b
103
117
101
M
150
105
207c
209
201
207b
θ
L
117
206a
202
207a
118a
H
J
133,134
G
PHOTO-
INTRPTR
130
120
119
125
140
135
118
I
CNTRLR
PHOTO-
INTRPTR

Fig. 7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209
201
135
118
119
207a
125
120
203
206a
105
206b

Fig. 8

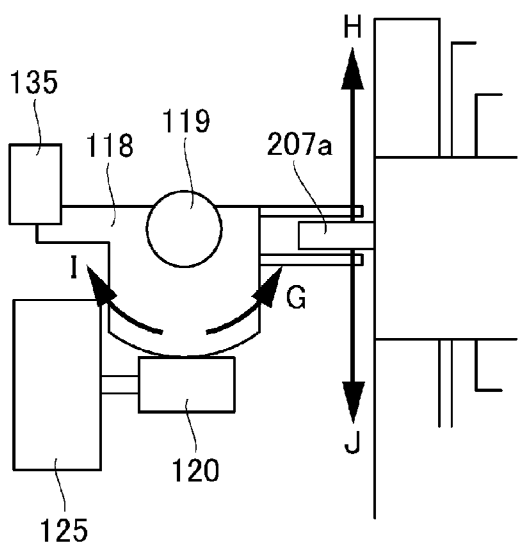
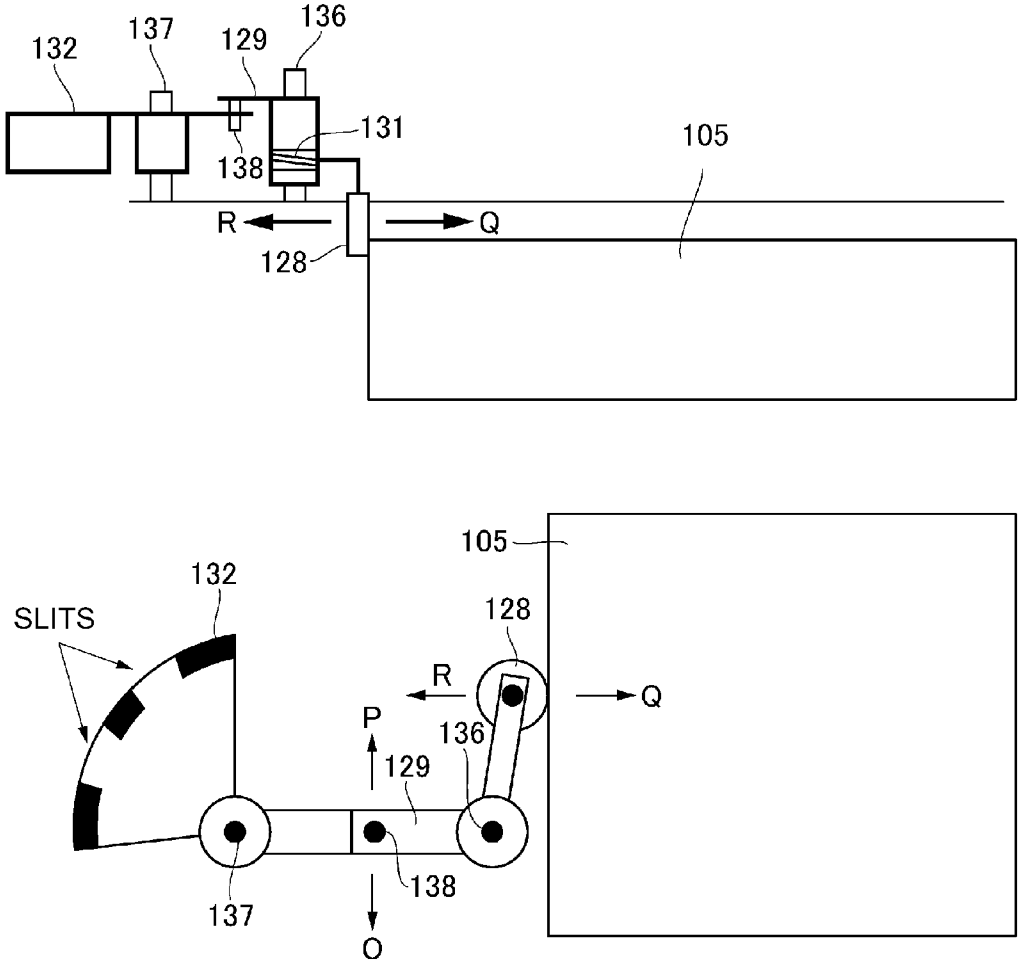

H
135
119
118
207a
I
G
J
120
125

Fig. 9


132
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129
136
131
105
138
R
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132
SLITS
128
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Q
P
136
129
138
137
O

Fig. 10

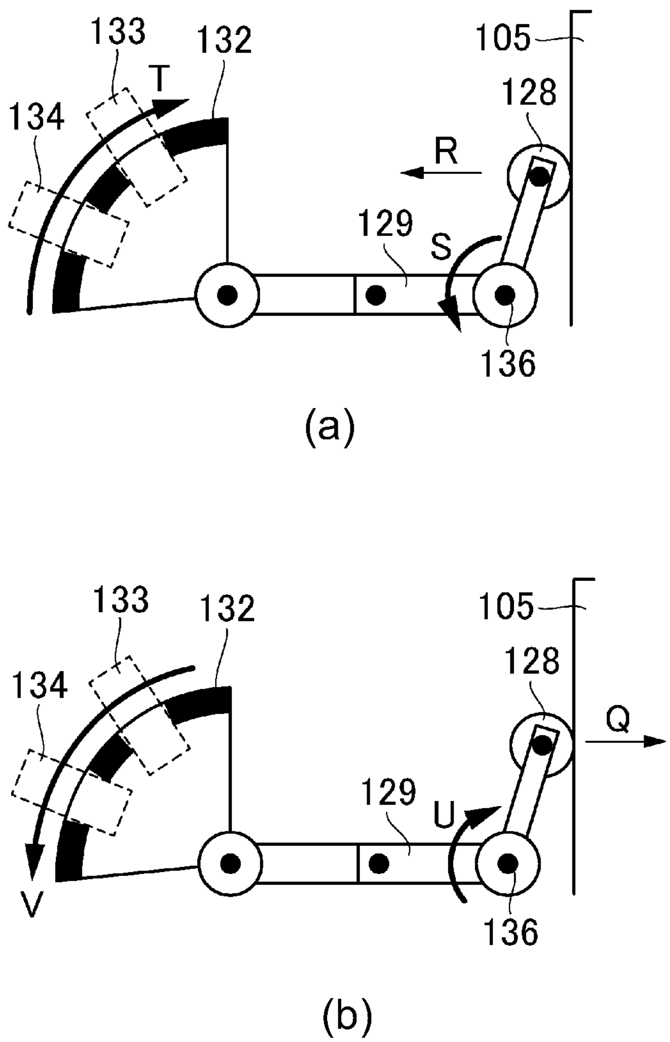

133
132
T
134
105
128
R
129
S
136
(a)
133
132
134
105
128
Q
129
U
V
136
(b)

Fig. 11

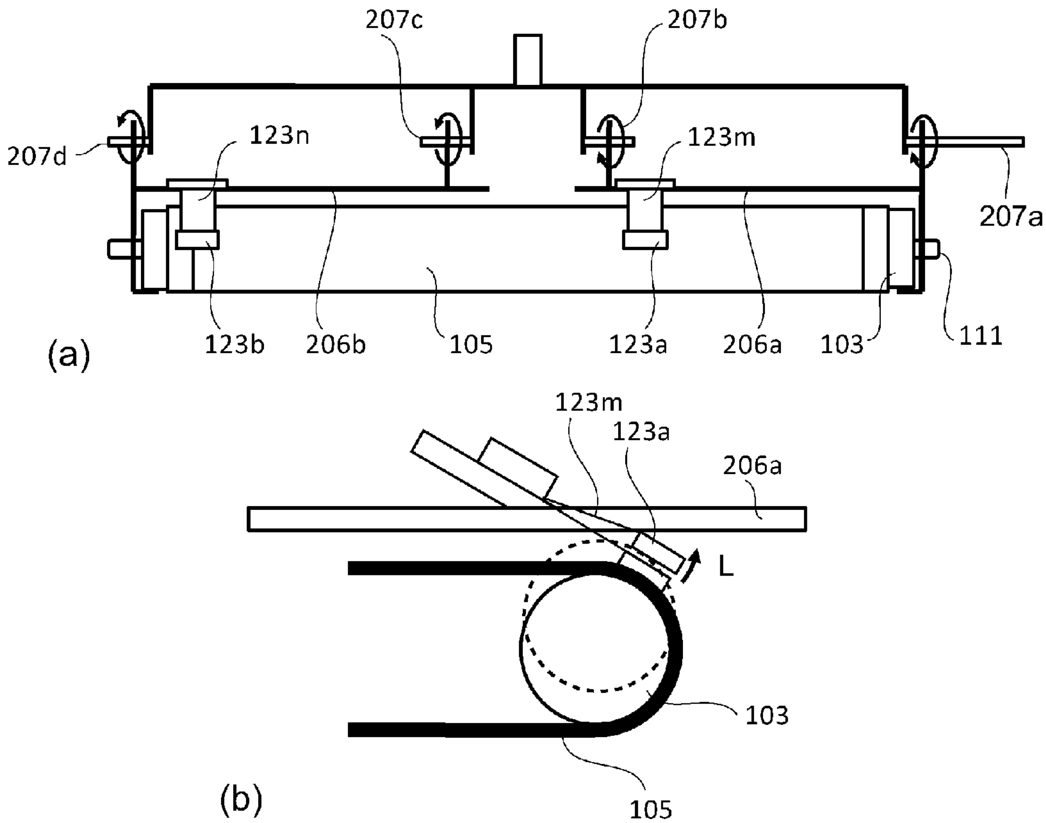

207c
207b
207d
123n
123m
207a
(a)
123b
206b
105
123a
206a
103
111
123m
123a
206a
L
103
(b)
105

Fig. 12

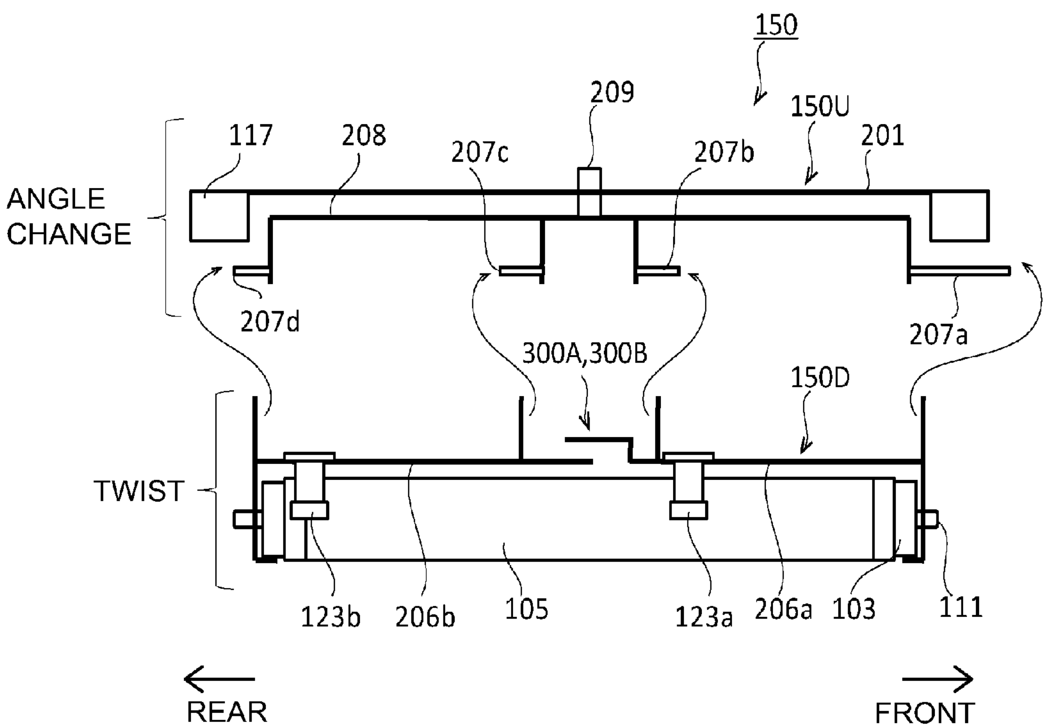

150
209
150U
117
208
207c
207b
201
ANGLE CHANGE
207d
207a
300A,300B
150D
TWIST
123b
206b
105
123a
206a
103
111
REAR
FRONT

Fig. 13

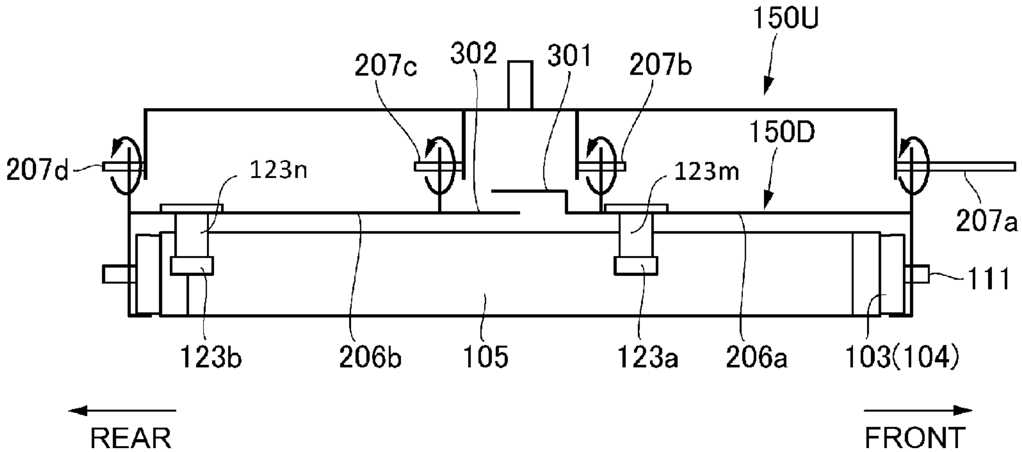
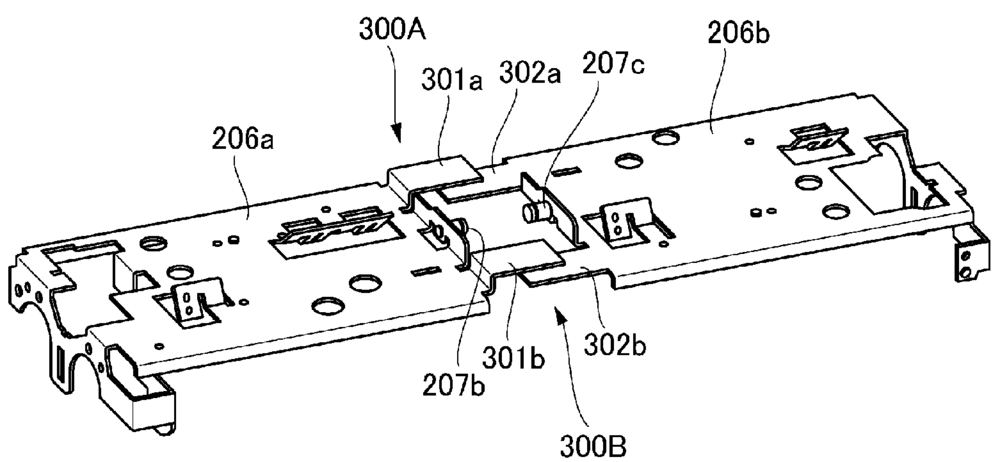

150U
207c
302
301
207b
150D
207d
123n
123m
207a
111
123b
206b
105
123a
206a
103(104)
REAR
FRONT

Fig. 14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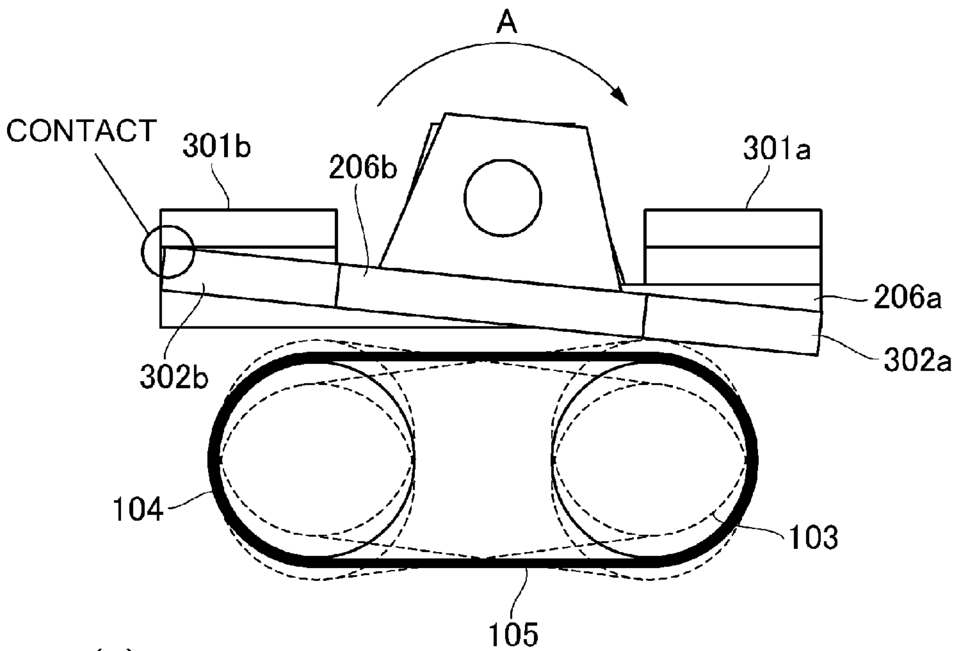
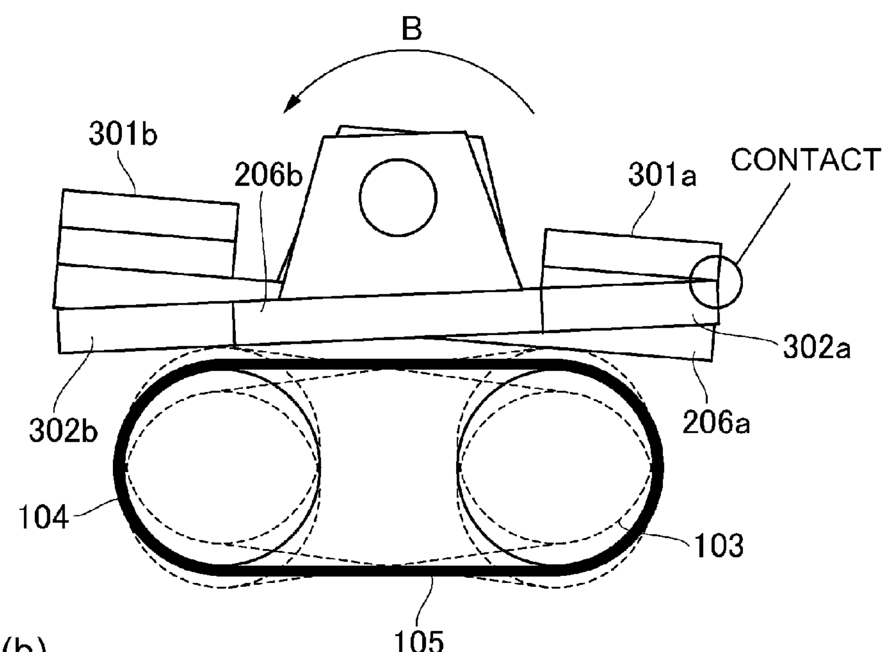
206b
301a
302a
207c
206a
207b
301b
302b
300B

Fig. 15

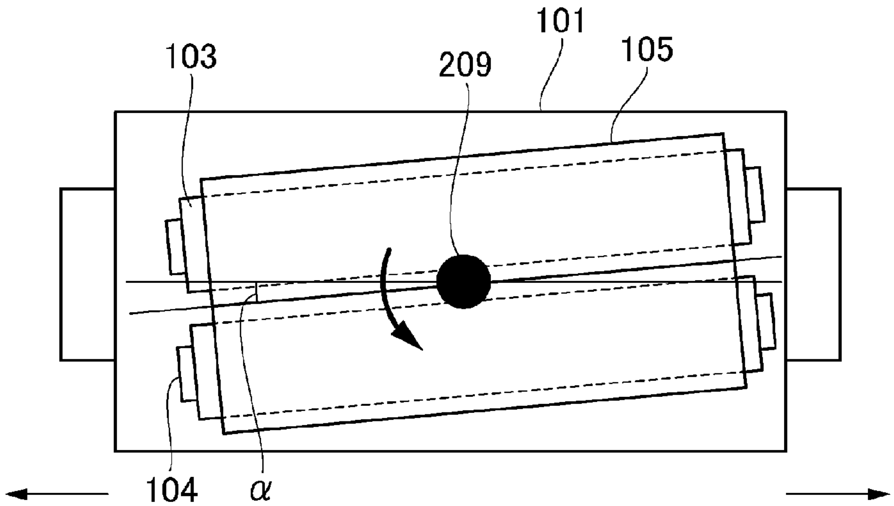

A
CONTACT
301b
206b
301a
206a
302a
302b
104
103
105

(a)

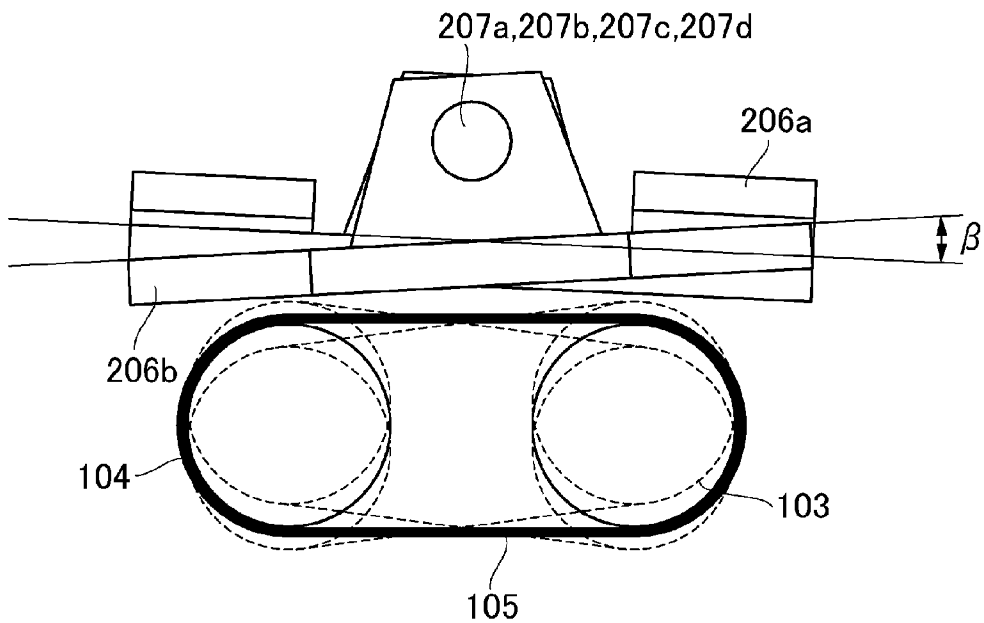

B
301b
206b
301a
CONTACT
302a
302b
206a
104
103
105

(b)

Fig. 16

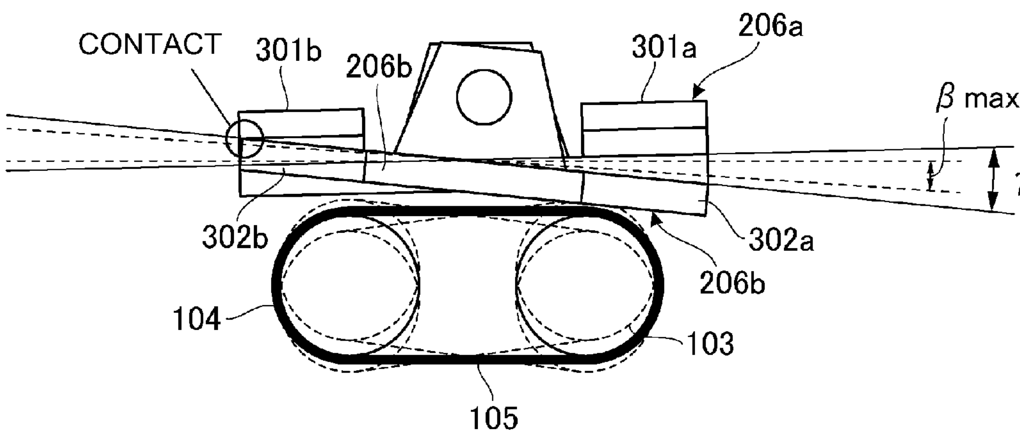

101
103
105
209
104
α
FRONT
REAR

(a)


207a,207b,207c,207d
206a
β
206b
104
103
105

(b)

Fig. 17



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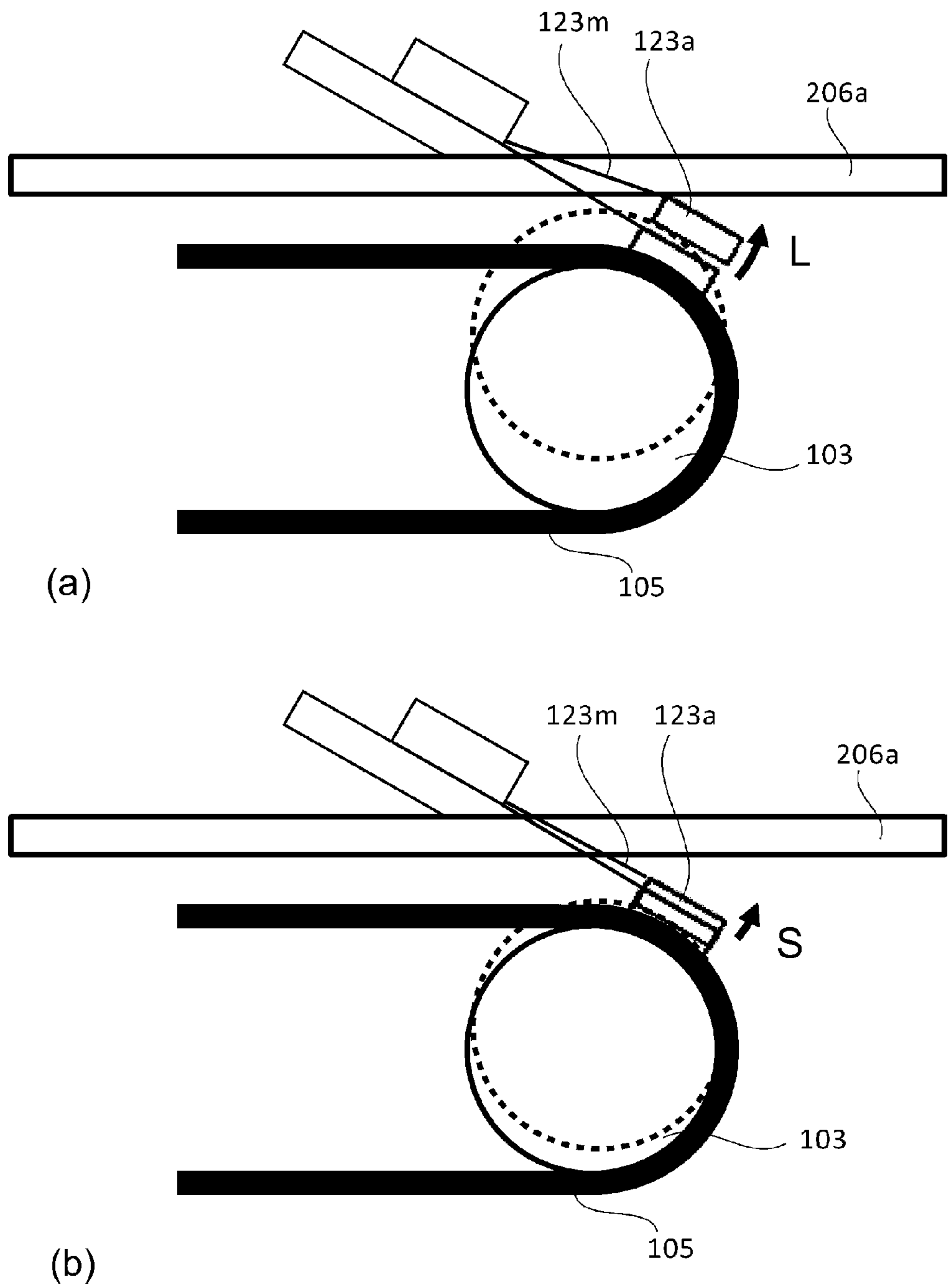

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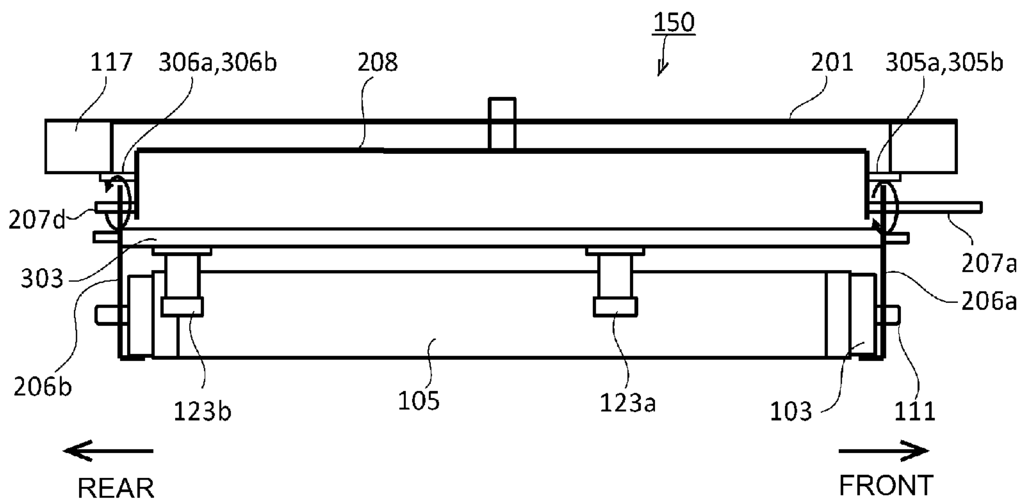
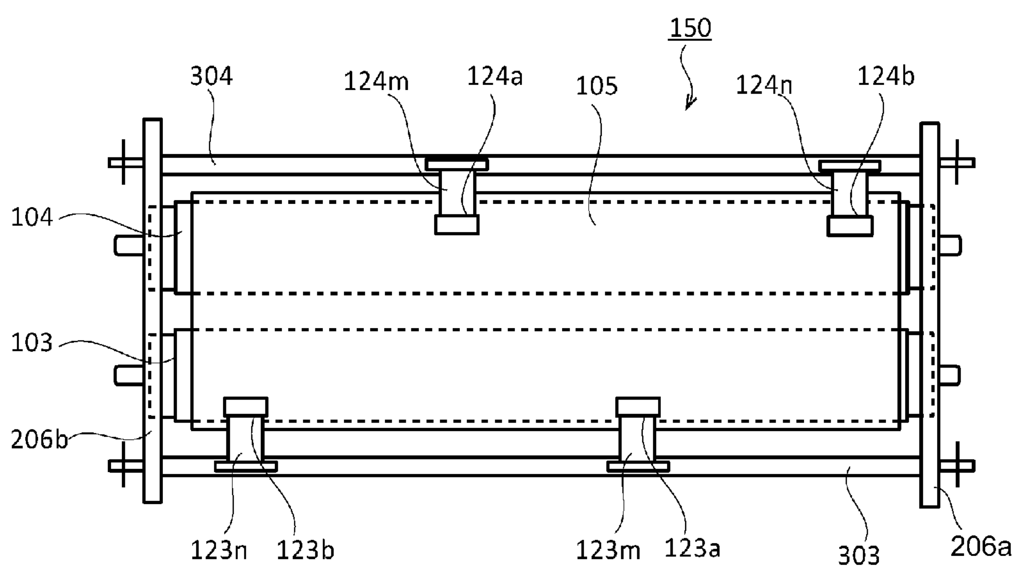

150
117
306a,306b
208
201
305a,305b
207d
207a
303
206a
206b
123b
105
123a
103
111
REAR
FRONT

Fig. 20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304
124m
124a
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124n
124b
104
103
206b
123n
123b
123m
123a
303
206a

Fig. 21

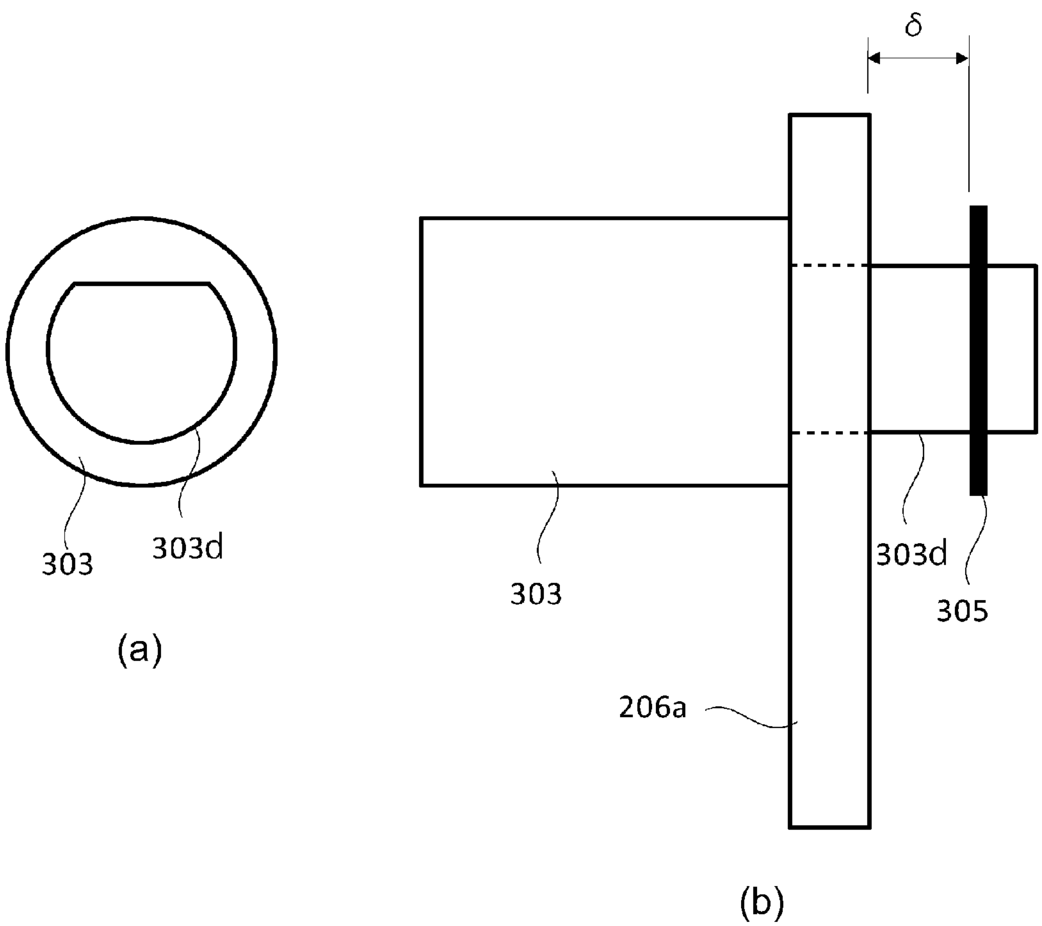
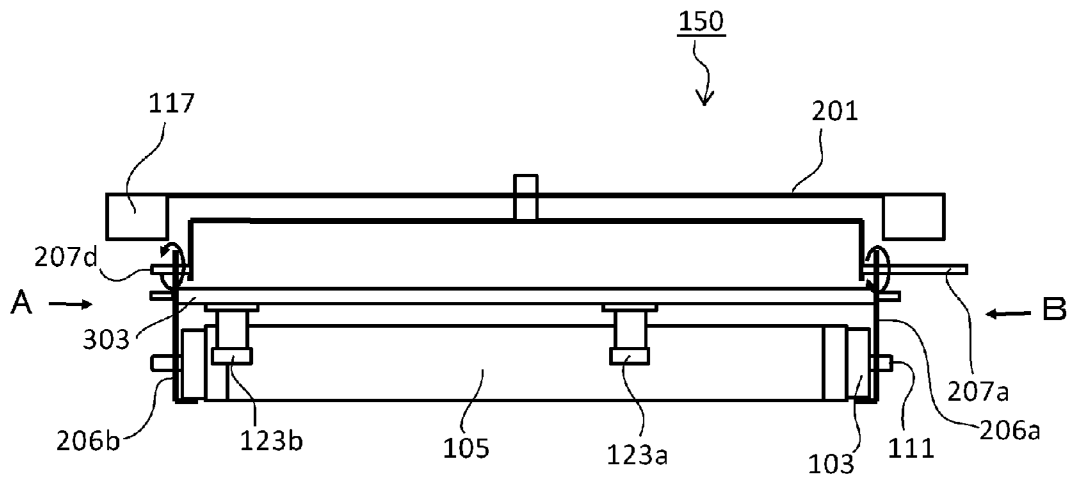


Fig. 22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207d
A
B
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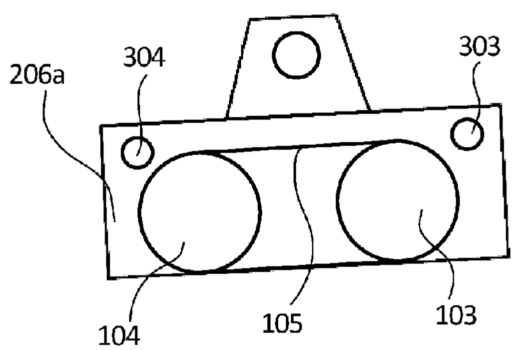
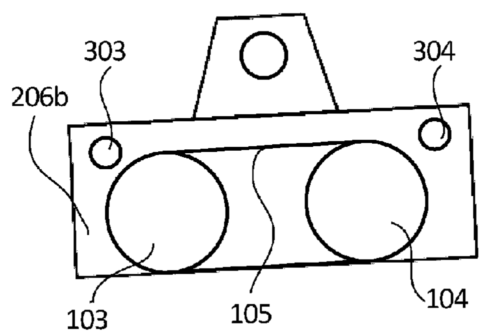
207a
206a
206b
123b
105
123a
103
111

(a)

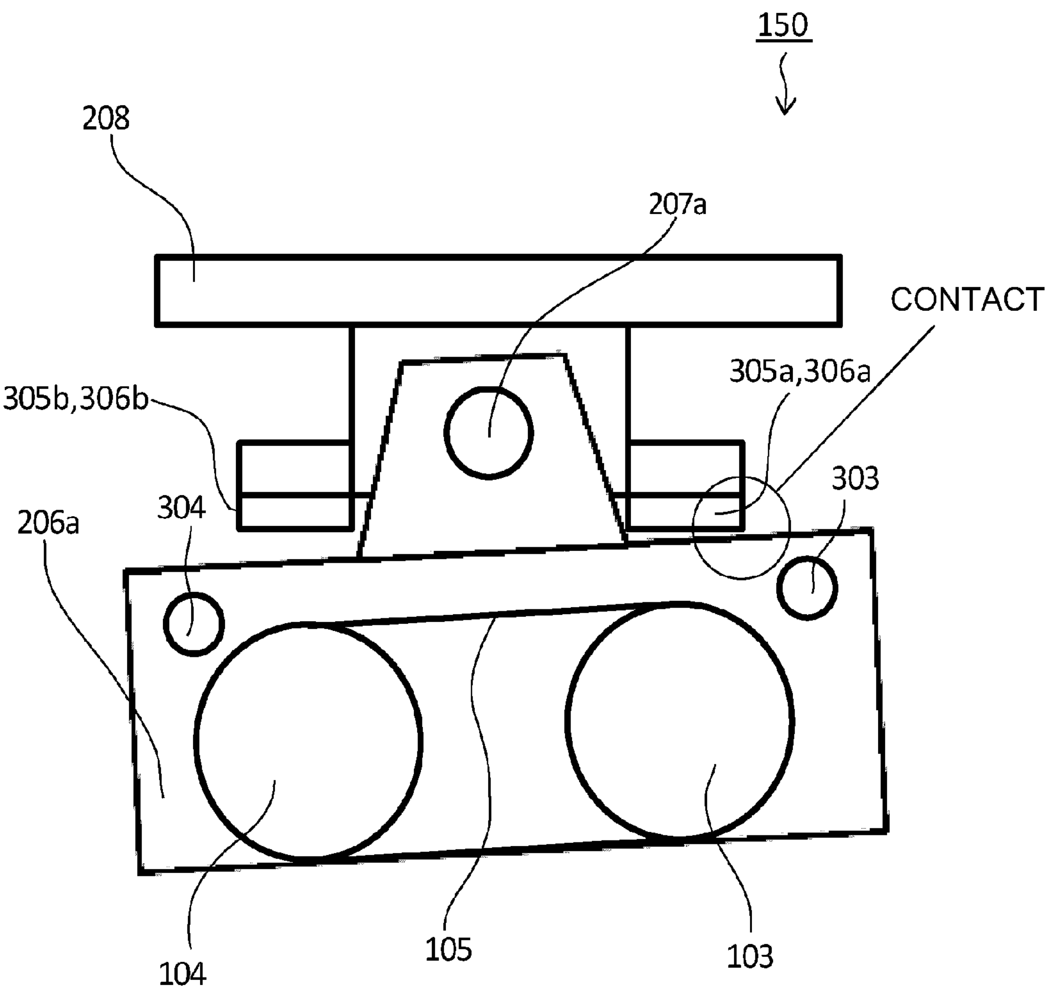

206a
304
303
104
105
103

(b)


206b
303
304
103
105
104

(c)

Fig. 23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208
207a
CONTACT
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305a,306a
303
304
206a
104
105
103

Fig. 24

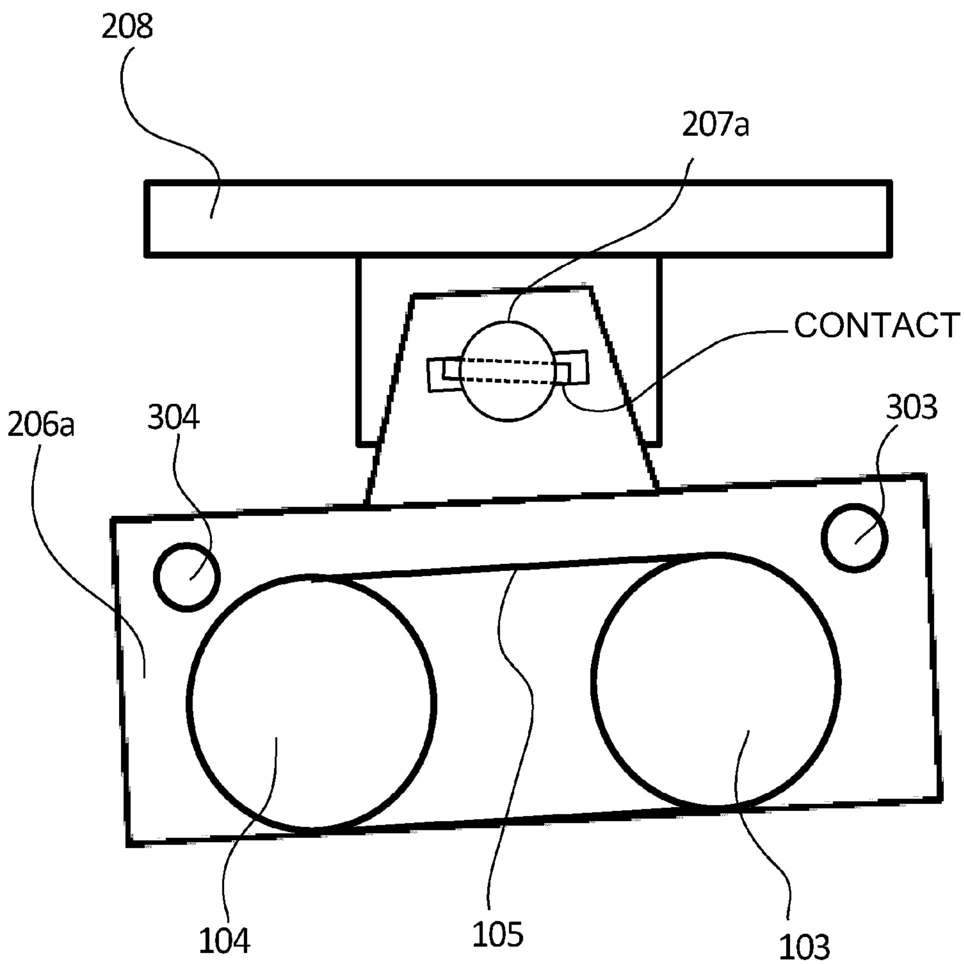

Fig. 25

IMAGE HEATING APPARATUS

FIELD OF THE INVENTION AND RELATED ART

The present invention relates to an image heating apparatus which heats a toner image on a sheet of recording medium.

In the field of an electrophotographic image forming apparatus, it has been a common practice to fix a toner image formed on a sheet of recording medium with the use of an electrophotographic process, to the sheet of recording medium, by applying heat and pressure to the sheet and the toner image thereon, with the use of a fixing apparatus (device) which is an example of an image heating apparatus (device).

In the recent years, an electrophotographic image forming apparatus has been increased in speed. Thus, it has become a common practice to equip a fixing apparatus (device) with an external means for externally heating the fixation roller (rotational heating member) of the fixing device. One of such external heating means which employ a heat belt has been proposed in Japanese Laid-open Patent Applications 2004-198658, and 2007-212896.

More concretely, in the case of the apparatus disclosed in Japanese Laid-open Patent Application 2004-198659, an external heat belt is supported and kept stretched by three belt supporting rollers, and is placed in contact with the peripheral surface of the fixation roller. In the case of Japanese Laid-open Patent Application 2007-212896, an external heat belt is suspended and kept stretched by two belt supporting rollers, and is placed in contact with the peripheral surface of the fixation roller.

Realistically speaking, it is rather difficult to assembly a fixing device so that its rollers for supporting, and keeping stretched, its external heat belt, become, and remain, virtually perfectly parallel to each other. However, unless the two rollers remain perfectly parallel to each other, the external heat belt deviates in its widthwise direction, and therefore, it is likely for the external heat belt to become unstable in its rotational movement. Thus, there have been devised various methods for controlling the external heat belt in its deviation in its widthwise deviation. One of such methods is to slant one of the two belt supporting rollers relative to the other. However, in a case where the external heat belt is employed to heat a fixation roller, it is difficult to satisfactorily employ this method, for the following reason.

That is, in the case of this method, the external heating unit is structured so that one of the lengthwise ends of one of the belt supporting rollers is displaced relative to the other lengthwise end. Thus, it is possible that a part of the external heat belt, which is to remain in contact with the fixation roller, is separated from the fixation roller by the displacement of the belt supporting roller. Therefore, it is possible that the external heat belt will fail to satisfactorily heat the fixation roller. Therefore, it is possible that unsatisfactory fixation will occur.

SUMMARY OF THE INVENTION

According to an aspect of the present invention, there is provided an image heating apparatus includes a rotatable heating member configured to heat a toner image on a recording material; a belt unit including an endless belt configured and positioned to contact with said rotatable heating member to heat it, and first and second supporting members rotatably supporting an inner surface of said belt and configured to urge said belt to said rotatable heating member; a detector configured and positioned to detect that said belt is deviated from a predetermined zone with respect to a widthwise direction said belt; a rotating mechanism configured to rotate said belt unit in a direction for returning said belt into the predetermined zone; a displacing mechanism configured to permit said first supporting member to displace, with rotation of said belt unit by said rotating mechanism, in a direction for substantially equalizing forces, from said first supporting member, urging said belt toward said rotatable heating member at opposite end portions of said first supporting member with respect to the widthwise direction and to permit said second supporting member to displace, with the rotation of said belt unit by said rotating mechanism, in a direction for substantially equalizing forces, from said second supporting member, urging said belt toward said rotatable heating member at opposite end portions of said second supporting member with respect to the widthwise direction; and a limiting mechanism configured and positioned to limit an amount of the displacement permitted by said displacing mechanism within a predetermined amount.

According to another aspect of the present invention, there is provided an image heating apparatus comprising a rotatable heating member configured to heat a toner image on a recording material; a belt unit including an endless belt configured and positioned to contact with said rotatable heating member to heat it, and first and second supporting rollers rotatably supporting an inner surface of said belt and configured to urge said belt to said rotatable heating member; a detector configured and positioned to detect that said belt is deviated from a predetermined zone with respect to a widthwise direction said belt; a rotating mechanism configured to rotate said belt unit in a direction for returning said belt into the predetermined zone; a displacing mechanism configured to permit said first and second rollers to displace, with rotation of said belt unit by said rotating mechanism, into a positional relation in which axes of said first and second supporting rollers are skewed relative to each other; and a limiting mechanism configured and positioned to limit an amount of the displacement permitted by said displacing mechanism within a predetermined amount.

Further features of the present invention will become apparent from the following description of exemplary embodiments (with reference to the attached drawings).

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic drawing for describing the structure of a typical image forming apparatus to which the present invention is applicable.

FIG. **2** is a schematic drawing for describing the structure of the fixing device in the first embodiment of the present invention.

FIG. **3** is a schematic drawing for describing the engaging-disengaging mechanism, in the first embodiment, for placing the external heating belt in contact with, or separating the external heating belt from, the fixing roller.

FIG. **4** is a schematic drawing for describing the mechanism for rotationally moving the holding frames.

FIG. **5** is a schematic drawing for describing the angle between the generatrix of the fixation roller and that of the external heat belt.

FIG. **6** is a schematic drawing for describing how the rotational movement of the external heating unit can cancel the effect of the controlling of the lateral deviation of the external heat belt (how rotational movement of the external heating unit can prevent nip between external heat belt and fixation roller from becoming nonuniform in internal pressure).

FIG. **7** is a schematic drawing for describing the steering mechanism for steering the external heat belt.

FIG. **8** is a schematic drawing for describing the driving portion section for driving the steering mechanism.

FIG. **9** is an enlarged schematic view of the driving portion of the steering mechanism.

FIG. **10** is a schematic drawing for describing the positioning of the sensor for detecting the amount of lateral deviation of the external heat belt.

FIG. **11** is a schematic drawing for describing the relationship between the direction of the external heat belt deviation and the direction of the rotational movement of the sensor flag.

FIG. **12** is a schematic drawing for describing the comparative external heating unit.

FIG. **13** is a schematic drawing for describing the positioning of the regulating portion in the first embodiment.

FIG. **14** is a schematic drawing for describing the movement of the holding frames.

FIG. **15** is a perspective view of the regulating portion.

FIG. **16** is a schematic drawing for describing the operation of the regulating portion.

FIG. **17** a schematic drawing for describing the rotational angle of the holding frames relative to each other.

FIG. **18** is a schematic drawing for describing the range to which the angle by which the holding frames are allowed to rotationally move relative to each other is limited.

FIG. **19** is a schematic drawing for describing the effects of the first embodiment.

FIG. **20** is a schematic drawing for describing the positioning of the regulating portion in the second embodiment.

FIG. **21** is a schematic drawing for describing the positioning of the thermistors in the second embodiment.

FIG. **22** is a schematic drawing for describing the structure of the mechanism for preventing the sensor supporting shaft from rotating relative to the holding frame.

FIG. **23** is a schematic drawing for describing the rotational movement of the holding frames relative to each other.

FIG. **24** is a schematic drawing for describing the operation of the regulating portion in the second embodiment.

FIG. **25** is a schematic drawing of the regulating portion in the third embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, the embodiments of the present invention are described in detail with reference to appended drawings.

<Image Forming Apparatus>

FIG. **1** is a schematic drawing for describing the structure of a typical image forming apparatus to which the present invention is applicable. Referring to FIG. **1**, an image forming apparatus **100** is a full-color printer of the tandem-type, and also, of the intermediary transfer type. It has image formation stations Pa, Pb, Pc and Pd for forming yellow, magenta, cyan and black toner images, respectively, and an intermediary transfer belt **130**. The four image formation stations are aligned in parallel (tandem) along the intermediary transfer belt **130**.

In the image formation station Pa, a yellow toner image is formed on a photosensitive drum **3***a*, and is transferred (primary transfer) onto the intermediary transfer belt **130**. In the image formation station Pb, a magenta toner image is formed, and is transferred (primary transfer) onto the intermediary transfer belt **130**. In the image formation stations Pc and Pd, cyan and black toner images, respectively, are formed, and are transferred (primary transfer) onto the intermediary transfer belt **130**. That is, the yellow, magenta, cyan, and black toner images are sequentially transferred (primary transfer) onto the intermediary transfer belt **130**.

Sheets P of recording medium in a recording medium cassette **10** are moved out of the cassette **10** one by one, and each sheet P is conveyed to a pair of registration rollers **12**, at which the sheet P is kept on standby. Then, the registration rollers **12** convey the sheet P to the secondary transfer station T2, with such a timing that the sheet P reaches the secondary transfer station T2 at the same time as the four toner images, different in color, on the intermediary transfer belt **130**. Then, while the sheet P is conveyed through the secondary transfer station T2, the toner images are transferred (secondary transfer) from the intermediary transfer belt **130** onto the sheet P. Then, the sheet P is conveyed to the fixing device **9**, in which the sheet P and the toner images thereon are subjected to heat and pressure, whereby the toner images are fixed to the sheet P. Then, the sheet P is discharged into the external delivery tray **7** of the image forming apparatus **100**.

The image formation stations Pa, Pb, Pc and Pd are practically the same in structure, although they are different in the color of the toner used by their developing devices **1***a*, **1***b*, **1***c* and **1***d*, respectively. Thus, only the image formation Pa is described, in order not to repeat the same descriptions.

The image formation station Pa has the photosensitive drum **3***a*, a charge roller **2***a*, an exposing device **5***a*, a developing device **1***a*, a primary transfer roller **6***a*, and a drum cleaning device **4***a*. The charge roller **2***a*, exposing device **5***a*, developing device **1***a*, primary transfer roller **6***a*, and drum cleaning device **4***a* are disposed in the adjacencies of the peripheral surface of the photosensitive drum **3***a*, in the listed order. The photosensitive drum **3***a* is made up of an aluminum cylinder, and a photosensitive layer formed on the peripheral surface of the aluminum cylinder.

The charge roller **2***a* uniformly charges the peripheral surface of the photosensitive drum **3***a* to a preset potential level. The exposing device **5***a* writes an electrostatic image on the peripheral surface of the photosensitive drum **3***a*, by scanning the uniformly charge portion of the peripheral surface of the photosensitive drum **3***a*, with a beam of laser light which it emits. The primary transfer roller **6***a* transfers (primary transfer) the toner images on the peripheral surface of the photosensitive drum **3***a* onto the intermediary transfer belt **130**, by being given voltage.

The drum cleaning device **4***a* is provided with a cleaning blade. It recovers the transfer residual toner, which is the toner having escaped from the primary transfer process, and therefore, remaining adhered to the peripheral surface of the photosensitive drum **3***a* after the primary transfer, by causing the cleaning blade to scrape the peripheral surface of the photosensitive drum **3***a*. The belt cleaning device **15** recovers the transfer residual toner, which is the toner having escaped from the process carried out in the secondary transfer station T2 to transfer the toner on the intermediary transfer belt **130** onto the sheet P of recording medium, and therefore, remaining on the intermediary transfer belt **130** after the secondary transfer.

Embodiment 1

Referring to FIG. **2**, a fixation roller **101**, which is an example of a rotational member, rotates in contact with a sheet P of recording medium. An external heat belt **105**, which is an example of member in the form of a belt is for adjusting the fixation roller **101** in thermal characteristic. It rotates in contact with the fixation roller **101**.

The first and second support rollers **103** and **104**, which are examples of multiple belt supporting members (rotational belt supporting members), support, and keep stretched, the external heat belt **105**. A thermistor **123** which is an example of a temperature detecting member (temperature detection element) is placed in contact with the outward surface of the external heat belt **105** to detect the temperature of the belt **105**.

Referring to FIG. **3**, a holding frame **206***a* which is an example of the first holding member (which is part of displacing mechanism or skewing mechanism, as well, which is described later) rotatably holds one of the lengthwise ends of the first support roller **103**, and the corresponding lengthwise end of the second support roller **104**. A holding frame **206***b* which is an example of the second holding member (which is part of displacing mechanism, which will be described later) rotatably holds the other lengthwise end of the first support roller **103**, and the corresponding lengthwise end of the second holding roller **104**. A middle frame **208** which is an example of a displacing mechanism (rotational mechanism) rotatably supports the support frames **206***a* and **206***b* in such a manner that the first and second support rollers **103** and **104** can be slanted (angled) relative to each other.

Referring to FIG. **7**, a worm wheel **118** which is an example of a rotational mechanism controls the external heat belt **105** in position in terms of the widthwise direction of the external heat belt **105**, that is, the direction parallel to the lengthwise direction of the first and second rollers **103** and **104**. The worm wheel **118** rotationally moves the middle frame **208** in such a manner that the generatrix of the external heat belt **105** and the generatrix of the fixation roller **101** are angled relative to each other. A photo-interrupters **133** and **134** detect the position of the external heat belt **105** in terms of the widthwise direction of the external heat belt **105**, that is, the direction parallel to the lengthwise direction of the first and second support rollers **103** and **104**. A control section **140** is a part of the abovementioned rotational mechanism. It controls the external heat belt **105** in position, by moving the worm wheel **118** in response to the outputs of the photo-interrupters **133** and **134**.

Referring to FIG. **15**, regulating portions **300**A and **300**B, which are examples of a regulating mechanism, function as a stopper for limiting to a preset value, the maximum angle by which the holding frames **206***a* and **206***b* are rotationally movable relative to each other. Next, referring to FIG. **18**, a preset angle (γ) is greater than the maximum angle (β_{max}) by which the holding frames **206***a* and **206***b* are allowed to be rotationally move relative to each other, in order to control the lateral deviation of the external heat belt **105**.

Referring to FIG. **15**, bent portions **301***a* and **301***b*), which are examples of the first portion of contact, extend from the inward edge of the holding frame **206***a* toward the holding frame **20***b*, along the first and second support rollers **103** and **104**. Flat portions **302***a* **302***b*, which are examples of the second portion of contact, extend from the inward edge of the holding frame **206***b* toward the holding frame **206***a*, along the first and second support rollers **103** and **104**. In terms of the direction in which the external heat belt **105** is suspended and stretched, the bent portion **301***a* and **301***b* are positioned, on one side of the combination of the first and second holding frames **206***a* and **206***b*, in such a manner that as the holding frames **206***a* and **206***b* are rotationally moved relative to each other, they overlap with each other. Further, the bent portion **302***a* and **202***b* are positioned, on the other side of the combination of the first and second holding frames **206***a* and **206***b*, in such a manner that as the holding frames **206***a* and **206***b* are rotationally moved relative to each other, they overlap with each other.

Referring to FIG. **14**, a thermistor **123***a* is attached to one of the lengthwise ends of a leaf spring **123***m*, which is an example of a beam-like member (pressing member). The other lengthwise end of the leaf spring **123***m* is fixed to the holding frame **206***a*. That is, the leaf spring **123***m* is attached to the holding frame **206***a*, acting thereby like a cantilever. It keeps the thermistor **123***a* in contact with the external heat belt **105** by being elastically bent. The aforementioned preset angle (γ) is set to be smaller than the maximum angle by which the holding frames **206***a* and **206***b* are allowed to rotationally move relative to each other while ensuring that the elastic deformation of the leaf spring **123***m* can keep thermistor **123***a* in contact with the external heat belt **105**.

(Fixing Device)

FIG. **2** is a schematic drawing for describing the structure of the fixing device in the first embodiment of the present invention. Referring to FIG. **2**, the fixing device **9** has the fixation roller **101** and pressure roller **102**. It is structured so that the pressure roller **102** is pressed upon the fixation roller **101** to form a nip N, through which a sheet P of recording medium, across which an unfixed toner image K is borne, is conveyed, remaining pinched by the fixation roller **101** and pressure roller **102**, so that the toner, of which the unfixed toner image K is formed, is melted and becomes fixed to the surface of the sheet P.

The fixation roller **101** has: a metallic core **101***a*; an elastic layer **101***b* formed across the entirety of the peripheral surface of the metallic core **101***a*; and a parting layer **101***c* formed across the entirety of the outward surface of the elastic layer **101***b*. The fixation roller **101** is driven by a driving mechanism **141** which includes an unshown gear train. It is rotated in the direction indicated by an arrow mark A in FIG. **2**, at a process speed of 300 mm/sec.

The pressure roller **102** has: a metallic core **102***a*; an elastic layer **102***b* formed across the entirety of the peripheral surface of the metallic core **102***a*; and a parting layer **102***c* formed across the entirety of the outward surface of the elastic layer **102***b*. It is driven by the driving system **141**, and rotates in the direction indicated by an arrow mark B in FIG. **2**. The pressure roller **102** is placed in contact with, or separated from, the fixation roller **101**, by being driven by an unshown pressure applying mechanism which employs an eccentric cam. The unshown pressure applying mechanism applies a preset amount of pressure to the pressure roller **102** to press the pressure roller **102** upon the fixation roller **101**, forming the nip N between the fixation roller **101** and pressure roller **102**.

The halogen heater **111** is non-rotationally disposed in the hollow of the metallic core **101***a* of the fixation roller **101**. A thermistor **121** is disposed in contact with the fixation roller **101** to detect the surface temperature of the fixation roller **101**. The control section **140** turns on or off the halogen heater **111** in response to the surface temperature of the fixation roller **101** detected by the thermistor **121**, in order to keep the surface temperature of the fixation roller **101** at a preset target level, which is set according to recoding medium type.

The halogen heater **112** is non-rotationally disposed in the hollow of the metallic core **102***a* of the pressure roller **102**. A thermistor **122** is placed in contact with the pressure roller **102** to detect the surface temperature of the pressure roller **102**. The control section **140** turns on or off the halogen heater **112** in response to the surface temperature of the pressure roller **102** detected by the thermistor **122**, in order to keep the surface temperature of the pressure roller **102** at a preset target level.

(External Heat Belt)

Referring to FIG. **2**, the image forming apparatus is required to be high in productivity (print output count per unit length of time) even when such recording medium as a sheet of cardstock or the like which is large in basis weight (weight per unit area), is used for image formation. In order to keep the image forming apparatus **100** high in productivity even when the recording medium used for an image forming operation is large in basis weight, the fixing device **9** of the image forming apparatus has to be enabled to remain high in heating performance even when the recording medium used for the image forming operation is large in basis weight. The amount by which recording medium which is large in basis weight robs heat from the fixation roller **101** is larger than the amount by which ordinary paper robs heat from the fixation roller **101**. Therefore, the amount of heat which the former require for fixation is greater than that for the latter. Thus, the fixing device **9** is structured so that the external heat belt **105** can be placed in contact with, or separated from, the fixation roller **101**. The external heat belt **105** increases the first and second support rollers **103** and **104** in the efficiency with which the rollers **103** and **104** can heat the fixation roller **101**, by increasing in size the area of indirect contact between the first and second rollers **103** and **104** and the fixation roller **101**, through which heat is conducted from the two rollers **103** and **104** to the fixation roller **101**.

The external heat belt **105** is placed in contact with the peripheral surface of the fixation roller **101**, forming thereby a nip Ne, in which it externally heats the fixation roller **101**. The external heat belt **105** has a substrative layer formed of a metallic substance such as stainless steel and nickel, or resinous substance such as polyimide. In order to prevent toner from adhering to the substrative layer of the external heat belt **105**, the surface of the substrative layer is provided with a heat resistant slippery layer formed of fluorinated resin. The external heat belt **105** is driven by the friction which occurs between the peripheral surface of the fixation roller **101** and external heat belt **105** as the fixation roller **101** is rotated; it is rotated by the rotation of the fixation roller **101** in the direction indicated by an arrow mark C in FIG. **2**.

The first support roller **103** is formed of a metallic substance, such as aluminum, iron, stainless steel, etc., which is high in thermal conductivity. There is stationarily disposed a halogen heater **113**, in the hollow of the first support roller **103**, in such a manner that the axial line of the halogen heater **113** coincides with the rotational axis of the first support roller **103**. A thermistor **123** is placed in contact with the portion of the external heat belt **105**, which is supported by the first support roller **103**, and detects the temperature of the external heat belt **105**. The control section **140** turns on or off the halogen heater **113** in response to the temperature of the external heat belt **105** detected by the thermistor **123**, in order to keep the temperature of the first support roller **103** at a preset target level.

The second support roller **104** is formed of a metallic substance, such as aluminum, iron, stainless steel, etc., which is high in thermal conductivity. There is stationarily disposed a halogen heater **114**, in the hollow of the second support roller **104**, in such a manner that the axial line of the halogen heater **114** coincides with the rotational axis of the second support roller **104**. A thermistor **124** is placed in contact with the portion of the external heat belt **105**, which is supported by the first support roller **104**, and detects the temperature of the external heat belt **105**. The control section **140** turns on or off the halogen heater **114** in response to the temperature of the external heat belt **105** detected by the thermistor **124**, in order to keep the temperature of the second support roller **104** at a preset target level.

The target levels for the temperature control of the first and second support rollers **103** and **104** are set higher than the target level for the temperature control of the fixation roller **101**. Because the surface temperature of the first support roller **103** and the surface temperature of the second support roller **104** are kept higher than the surface temperature of the fixation roller **101**, heat is efficiently supplied to the fixation roller **101**, as the fixation roller **101** reduces in surface temperature. More concretely, in an image forming operation in which sheets of cardstock or the like are continuously conveyed, the target temperature level for the fixation roller **101** is set to 165° C., whereas the target temperature level for the first support roller **103**, and that for the second support roller **104**, are set higher by 75° C. than that for the fixation roller **101**.

The surface layer of the external heat belt **105** is soiled by adhesive contaminants such as toner particles, paper dust, and the like which offset to the external heat belt **105** from a sheet P of recording medium. The cleaning roller **108** has a surface layer formed of silicon rubber, and adheres the toner particles, paper dust, and the like on the surface layer of the external heat belt **105**, to its surface layer. The cleaning roller **108** is kept pressed upon the external heat belt **105** by a preset amount of pressure. It cleans the surface of the external heat belt **105** by being rotated by the rotation of the external heat belt **105**.

When the fixing device **9** is kept on standby for the next job, its external heat belt **105** is kept separated from its fixation roller **101**. As an image formation job is sent to the image forming apparatus **100**, various preparatory operations are started by various devices in the image forming apparatus **100**. One of the preparatory operation is the warmup operation started by the fixing device **9**. As the fixation roller **101**, and pressure roller **102** reach their target temperature level in the warmup operation, the external heat belt **105** is pressed upon the fixation roller **101**. Then, the image formation job is started. As the image formation job is completed, the external heat belt **105** is separated from the fixation roller **101**, and then, it is kept separated from the fixation roller **101** until the next image formation job is started.

(Angle Between Two Support Rollers)

FIG. **3** is a schematic sectional drawing for an engaging-disengaging mechanism for placing the external heat belt **105** in contact with the fixation roller **101**, or separating the external heat belt **105** from the fixation roller **101**. FIG. **4** is a schematic drawing for describing the mechanism for rotationally moving the holding frames. FIG. **5** is a schematic drawing for describing the skew angle between the generatrix of the fixation roller and that of the external heat belt **105**. FIG. **6** is a schematic drawing for describing the effects of the angle of rotational movement of the external heating unit **150** of the fixing device **9**, upon the prevention of the problem that controlling the external heat belt **150** in lateral deviation makes the nip between the external heat belt **105** and fixation roller **101**, nonuniform in internal pressure.

Referring to FIG. **3**, the external heating unit **150** is structured so that the external heat belt **105** is suspended and kept stretched by the first and second support rollers **103** and **104**, in such a manner that the external heat belt **105** is rotated by the rotation of the fixation roller **101**.

The external heat belt **105** can be placed in contact with, or separated from, the fixation roller **101** by the engaging-disengaging mechanism **200**. The mechanism **200** doubles as the mechanism for pressing the first and second support rollers

103 and **104** against the fixation roller **101** with the placement of the external heat belt **105** between the two support rollers **103** and **104** and the fixation roller **101**. A pressure application frame **201** is pivotally movable relative to the frame **9**f of the fixing device **9**, about a pivot **203**, by which the pressure application frame **201** is supported.

There is disposed a compression spring **204** between the lengthwise opposite end portion of the pressure application frame **201** from the pivot **203**, and the frame **9**f of the fixing device **9**. Thus, the compression spring **204** presses downward the opposite end of the pressure application frame **201** from the pivot **203**, pressing thereby the pressure application frame **201** toward the fixation roller **101**. The middle frame **208** is supported by a pair of middle rollers **210**, disposed on the front and rear sides of the middle frame **208**, in such a manner that they can be rotationally moved relative to the pressure application frame **201**. While the first and second support rollers **103** and **104** are remaining pressed against the fixation roller **101**, with the presence of the external heat belt **105** between the two rollers **103** and **104** and the fixation roller **101**, the overall amount of pressure generated by the compression spring **204** is 392 N (roughly 40 kgf).

A pressure removal cam **205** is placed in contact with, or separated from, the bottom surface of the tip portion of the pressure application frame **201**. The control section **140** controls a motor **210** to rotate the pressure removal cam **205** to pivotally move the pressure application frame **201** about the axle **205**a so that the tip portion of the pressure application frame **201** moves upward or downward. As the pressure removal cam **205** is separated from the pressure application frame **201**, the compression spring **204** is allowed to extend to move downward the tip portion of the pressure application frame **201**, and therefore, the external heat belt **105** is pressed upon the fixation roller **101**. As the pressure removal cam **205** moves the pressure application frame **201** upward while compressing the compression spring **204**, the external heat belt **105** is separated from the fixation roller **101**.

Referring to FIG. **4**, the front end of the first support roller **103**, and the front end of the second support roller **104**, are supported by the front holding frame **206**a, which is supported by the axles **207**a and **207**b so that it is allowed to rotationally move relative to the middle frame **208**. The holding frame **206**a rotatably holds the front end of the first support roller **103**, and the front end of the second support roller **104**, with the placement of unshown thermally insulating bushing, and bearing, between the holding frame **206**a and first and second support rollers **103** and **104**. That is, one of the lengthwise ends of the first support roller **103**, and the corresponding end of the second support roller **104**, are rotationally supported by the unshown bearings fixed to the holding frames **206**a, which is rotatably supported by the axles **207**a and **207**b, respectively, with which the middle frame **208** is provided.

The rear end of the first support roller **104**, and the rear end of the second support roller **104**, are supported by the rear holding frame **206**b, which is supported by the axles **207**c and **207**d so that it is allowed to rotationally move relative to the middle frame **208**. The holding frame **206**b supports the rear end of the first support roller **103**, and the rear end of the second support roller **104**, with the placement of unshown thermally insulating bushing, and bearing, between the holding frame **206**b and first and second support rollers **103** and **104**. That is, one of the lengthwise ends of the second support roller **103**, and the corresponding end of the second support roller **104**, are rotationally supported by unshown bearings fixed to the holding frame **206**b, which is rotatably supported by the axles **207**c and **207**d, respectively, with which the middle frame **208** is provided. The shafts **207**a-**207**d are coaxial.

Referring to FIG. **4**, there are disposed compression springs **204**a and **204**b at the lengthwise ends of the pressure application frame **201**, one for one. The compression springs **204** apply a preset amount of pressure to the first and second support rollers **103** and **104** to press the external heat belt **105** upon the peripheral surface of the fixation roller **101**. The line which is perpendicular to the axle **207** (**207**a, **207**b, **207**c and **207**d) and coincident to the center of the axle **207** and the axial line of the fixation roller **101** is perpendicular to, and bisects, the line which is coincident to the center of the first support roller **103** and the center of the second support roller **104**.

Referring to FIG. **5**, in a case where the angle between the generatrix of the external heat belt **105** and that of the fixation roller **101** is θ, the rear end of the first support roller **103** or the rear end of the second support roller **104** begins to press the fixation roller **101** before the other, and at the same time, the corresponding front end of the first support roller **103** or the second support roller **104** begins to press the fixation roller **101** before the other. That is, the first support roller **103** (or second support roller **104**) is slanted (angled) in such a manner that one of the lengthwise end of the first support roller **103** (or second support roller **104**) digs into the fixation roller **101**, and the other lengthwise end separates from the fixation roller **101**. Therefore, unless the external heating unit **150** is not provided with a displacing mechanism (rotational mechanism), the nip between the fixation roller **101** and external heat belt **105** becomes nonuniform in internal pressure in terms of the lengthwise direction of the fixation roller **101**.

On the other hand, in the case of a fixing device provided with a displacing mechanism (rotational mechanism) as shown in FIG. **6**(a), the difference between the first and second support rollers **103** and **104** in the amount of pressure they apply to the fixation roller **101** causes the front and rear holding frames **206**a and **206**b, respectively, to rotationally move. Thus, the first and second support rollers **103** and **104** are autonomously equalized in the amount of pressure they apply to the fixation roller **101**. More concretely, the front and rear holding frames **206**a and **206**b are rotationally moved relative to each other in the direction perpendicular to their lengthwise direction, being thereby positioned to accommodate the curvature of the fixation roller **101**. There is no limit to the angle by which the first and second support rollers **103** and **104** are rotationally moved relative to each other. Therefore, the first and second support rollers **103** and **104** autonomously adjust themselves in attitude, positioning themselves to accommodate the curvature of the fixation roller. Therefore, the external heat belt **105** is kept perfectly in contact with the fixation roller **101**.

Next, referring to FIG. **6**(b), on the front side of the fixing device **9**, the holding frame (**206**a) rotates about the axles **207**a and **207**b in such a manner that the difference between the amount of pressure between the first support roller **103** and fixation roller **101**, and that between the second support roller **104** and fixation roller **101** is eliminated. Next, referring to FIG. **6**(c), on the rear side of the fixing device **9**, holding frame (**206**b) rotates about the axles **207**c and **207**d in such a manner that the difference between the amount of pressure between the first support roller **103** and fixation roller **101**, and that between the second support roller **104** and fixation roller **101** is eliminated. Therefore, even though the angle θ between the external heat belt **105** and fixation roller **101** is changed by the controlling of the lateral deviation of the external heat belt **105**, the nip between the external heat belt **105** and fixation roller **101** remains uniform in the internal pressure.

That is, the first and second support rollers **103** and **104** become the same in the amount of pressure by which they are pressed against the fixation roller **101**. Therefore, the fixation roller **101** is satisfactorily heated by the first and second support rollers **103** and **104** through the external heat belt **105**, across its front side as well as the rear side.

(Steering Mechanism)

FIG. **7** is a schematic drawing for describing the mechanism (rotational mechanism) for steering the external heat belt **105**. FIG. **8** is a schematic drawing for describing the driving portion of the steering mechanism. FIG. **9** is an enlarged view of the driving portion of the steering mechanism.

Referring to FIG. **2**, the fixing device **9** is structured so that the adverse effect of the controlling of the lateral deviation of the external heat belt **105** is cancelled by rotationally moving the external heating unit **150** while keeping the first and second support rollers **103** and **104** unchanged in positional relationship.

Referring to FIG. **5**, in a case where the angle between the external heat belt **105** and fixation roller **101** is θ when the external heat belt **105** came into contact with the fixation roller **101**, the rotation of the fixation roller **101** generates a force that presses the external heat belt **105** in the direction which is parallel to the lengthwise direction of the first and second support rollers **103** and **104**. This principle (phenomenon) is used by the fixing device **9** to set the direction in which the external heat belt **105** is made to laterally shift. That is, the angle θ is intentionally changed to set the direction in which the external heat belt **105** is made to laterally shift.

As the external heat belt **105** is rotated, it laterally deviates in the direction parallel to the lengthwise direction of the first and second support roller **103** and **104**. The cause of this lateral deviation of the external heat belt **105** is that the first and second support roller **103** and **104** are not perfectly in parallel to each other, and also, that the aforementioned angle θ is not zero.

Referring to FIG. **7**, the axle **209** is positioned so that it extends in the direction which is perpendicular to the area of contact between the fixation roller **101** and external heat belt **105**. The axle **209** is a shaft about which the external heating unit **150** is rotationally moved to change the angle θ between the external heat belt **105** and fixation roller **101**. In terms of the direction perpendicular to the moving direction of the external heat belt **105**, the axle **209** is at the center of the external heating unit **150**. Therefore, the external heating unit **150** can keep the frond and rear sides of the nip, balanced in internal pressure, in terms of the lengthwise direction of the fixation roller **101**.

In order to control the direction in which the external heat belt **105** laterally shifts, the control section **140** changes the angle θ between the generatrix of the external heat belt **105** and that of the fixation roller **101** by rotationally moving together the first and second support rollers **103** and **014** about the axle **209**. That is, in order to keep the lateral deviation of the external heat belt **105** within a preset range, the control section **140** externally forces the angle θ between the generatrix of the external heat belt **105** and that of the fixation roller **101** to change in order to reverse the external heat belt **105** in the direction of its lateral shift.

An axle **203** by which the pressure application frame **201** is rotatably supported is fixed to the lateral plates **202** of the main assembly of the external heating unit **150**, by its lengthwise ends. The middle frame **208** and external heat belt **105** are rotationally movable together relative to the pressure application frame **201**, about the axle **209**. The axle **207*a*** is fixed to the middle frame **208**. Further, the lateral plate **202**, which corresponds in position to the axle **207*a***, is provided with such a hole that provides a certain amount of clearance between the axle **207*a*** and lateral plate **202**. Thus, the axle **207*a*** is allowed to be moved by the movement of the arm portion **118*a*** of the worm portion **118** in the directions indicated by arrow marks H and J, within the range which the clearance affords.

The worm wheel **118** is shaped like a fan, and is rotationally movable about the axle **119**. It is in engagement with the worm gear **120**. As the worm wheel **118** is rotated in the direction indicated by an arrow mark G, by the rotation of a motor **125** in the normal direction, the arm portion **118*a*** is moved in the direction indicated by the arrow mark H, causing thereby the axle **207*a*** to move in the direction of the arrow mark H. As the worm wheel **118** is rotated in the direction indicated by the arrow mark I by the rotation of the motor **125** in the reverse direction, the arm portion **118*a*** is moved in the direction indicated by the arrow mark J, causing thereby the axle **207*a*** to move in the direction of the arrow mark J (FIGS. **7** and **8**).

As the middle frame **208** is moved in such a direction that its front end moves in the direction indicated by the arrow mark H or J, the first and second support rollers **103** and **104** are made to rotationally moved together about the axle **209**. Consequently, the first and second support rollers **103** and **104** become angled relative to the fixation roller **101** by the angle θ. There is a correlation between the angle θ between the fixation roller **101** and external heat belt **105**, and the speed at which the external heat belt **105** is made to laterally shift. The amount of the force generated in the direction to laterally move the external heat belt **105** is affected by the distance by which the arm portion **118*a*** is moved. Thus, the direction in which the external heat belt **105** is made to laterally shift, and the speed with which the external heat belt **105** is made to laterally shift, are controlled by the direction in which the arm portion **118*a*** is moved, and the distance by which the arm portion **118*a*** is moved, respectively.

As the axle **207*a*** is moved in the direction indicated by the arrow mark H from the position in which the amount of the force which works in the direction to laterally shift the external heat belt **105** is zero, the force which works in the direction to move the external heat belt **105** rearward (indicated by arrow mark M) of the fixation roller **101** increases. On the other hand, as the axle **207*a*** is moved in the direction indicated by the arrow mark J from the position in which the amount of the force which works in the direction to laterally shift the external heat belt **105** is zero, the force which works in the direction to move the external heat belt **105** frontward (indicated by arrow mark L) of the fixation roller **101** increases. In other words, the direction (indicated by arrow mark M or L) in which the external heat belt **105** is made to laterally shift can be controlled by changing the direction (indicated by H or J, respectively) in which the axle **207*a*** is moved.

In this embodiment, the home position for the axle **207*a***, which is set by the worm wheel **118**, is such a position that makes the external heating unit **150** parallel to the fixation roller **101**. Whether the axle **207*a*** is in its home position or not is detected by a photo-interrupter **135** attached to the worm wheel **118**.

As the external heat belt **105** is rotated by the rotation of the fixation roller **101**, the external heat belt **105** laterally shifts frontward or rearward of the fixation roller **101**. Thus, the control section **140** moves the axle **207*a*** in the direction to move the external heat belt **105** in the opposite direction from the direction in which the external heat belt **105** has shifted.

(Belt Position Sensor)

FIG. **10** is a schematic drawing for describing the positioning of the belt position sensor. FIG. **11** is a schematic drawing for describing the positional relationship between the direction of the belt deviation, and the direction of the rotational movement of the sensor flag. Referring to FIG. **10**(*b*), an arm **129** and a roller **128** rotate together about an axle **137**. A sensor flag **132** rotates about the axle **137**.

Referring to FIG. **10**(*a*), the arm and sensor flag **132** are connected to each other by an axle **138**, and transmit the rotational movement of the combination of the arm **129** and roller **128**. The roller **128** is in contact with the edge of the external heat belt **105**. A torsion spring **131** provides the arm **129** with a torsional force that keeps the roller **128** pressed in the direction indicated by an arrow mark Q.

Referring to FIG. **10**(*b*), as the external heat belt **105** deviates in the direction indicated by the arrow mark Q, the axle **138** is moved in the direction indicated by an arrow mark P. On the other hand, as the external heat belt **105** deviates in the direction indicated by the arrow mark R, the axle **138** is moved in the direction indicated by an arrow mark O.

Referring to FIG. **11**(*a*), there are disposed a pair of photo-interrupters **133** and **134** along semicircular edge of the sensor flag **132**. The sensor flag **132** is provided with a pair of slits, which provides the sensor flag **132** with four edges, which are detected by the photo-interrupters **133** and **134**, which reverse their output as they detect the edges. The four edges of the sensor flag **132** are correlated to the amount of the deviation of the external heat belt **105**. For example, the photo-interrupters **132** and **133** are positioned so that the distance by which the external heat belt **105** laterally shifts before it reverses in direction becomes 5 mm. As the external heat belt **105** deviates in the direction indicated by the arrow mark R, the arm **129** is rotationally moved in the direction indicated by the arrow mark S. Thus, the sensor flag **132** is rotationally moved in the direction indicated by the arrow mark T. Consequently, the photo-interrupter **133** is turned off, and the photo-interrupter **134** is turned on.

Referring to FIG. **11**(*b*), as the external heat belt **105** deviates in the direction indicated by the arrow mark Q, the arm **129** is rotationally moved in the direction indicated by the arrow mark U. Thus, the sensor flag **132** is rotationally moved in the direction indicated by an arrow mark V. Consequently, the photo-interrupter **133** is turned on, and the photo-interrupter **134** is turned off.

(Comparative External Heating Unit)

FIG. **12** is a schematic drawing for describing the comparative fixing device.

Referring to FIG. **7**, the external heating unit **150** places its external heat belt **105** in contact with the fixation roller **101** to directly heat the peripheral surface of the fixation roller **101**. The external heating unit **150** rotationally moves about the axle **209** to change the angle θ between the generatrix of the external heat belt **105** and that of the fixation roller **101**, controlling thereby the external heat belt **105** in lateral shift. As the external heat belt **105** is controlled in lateral deviation, the holding frames **206***a* and **206***b* are rotationally moved relative to each other, about the combination of the axles **207***a* and **207***b*, and the combination of the axles **207***c*, and **207***d*, respectively. Thus, the first and second support rollers **103** and **104** are angled relative to each other. Consequently, the front and rear sides of the nip between the first support roller **103** and fixation roller **101**, and the front and rear sides of the nip between the second support roller **104**, become uniform in internal pressure in terms of the lengthwise direction of the fixation roller **101**.

In a case where an external heating unit (**150**) is structured so that there is no limit to the angle by which the first and second heat rollers **103** and **104** are allowed to rotationally moved relative to each other, it is possible that when the external heating unit (**150**) is assembled, and/or when the external heating unit (**150**) is lifted independently from the other portions of a fixing device, the angle between the first and second support rollers **103** and **104** will become excessive.

Referring to FIG. **12**(*a*), the surface temperature of the external heat belt **105** is detected by the thermistors **123** (**123***a* and **123***b*) which are in contact with the portions of the external heat belt **105**, which are in contact with the first support roller **103**. As the angle between the first and second support rollers **103** and **104** becomes excessive, the distance between the thermistors **123***a* and external heat belt **105**, and the distance between the thermistor **123***b* and external heat belt **105**, become smaller or larger than the amount of separation which is anticipated to occur as the external heat belt **105** is controlled in its lateral deviation.

Referring to FIG. **12**(*b*), in particular, the thermistor **123***a*, which is positioned close to the center of the external heat belt **105**, in terms of the widthwise direction of the external heat belt **105**, to detect the temperature of the center portion of the external heat belt **105**, is seriously affected by the distance. More specifically, if the leaf spring **123***m* by which the thermistor **123***a* is supported is permanently deformed by the excessive increase in the angle between the first and second support rollers **103** and **104**, it is possible that the thermistor **123***a* will fail to remain in contact with the outward surface of the external heat belt **105**.

In this embodiment, therefore, the comparative external heating unit **150** is provided with a limiter for limiting the angle by which the first and second support rollers **103** and **104** are allowed to be slanted (angled) relative to each other, in order to solve the above described problem which the comparative external heating unit **150** suffers. That is, in the case of the external heating unit **150** in the first embodiment, the limiter regulates the angle by which the first and second support rollers **103** and **104** are allowed to be angled relative to each other. Therefore, the amount by which the leaf spring **123***m*, by which the thermistor **123***a* is kept in contact with the external heat belt **105** to detect the surface temperature of the external heat belt **105**, is deformed is reduced.

(Regulating Portion)

FIG. **13** is a schematic drawing for describing the positioning of the regulating portions (limiting mechanisms) in the first embodiment. FIG. **14** is a schematic drawing for describing the operation of the holding frames. FIG. **15** is a perspective view of the regulating portions. FIG. **16** is a schematic drawing for describing the operation of the regulating portions.

Referring to FIG. **13**, the external heating unit **150** is separable into the top and bottom portions **150**U and **150**D. The top portion **150**U rotationally moves the middle frame **208** about the axle **209** to move the middle frame **208** relative to the pressure application frame **201**. The bottom portion **150**D is rotatably hung by the axles **207***a*, **207***b*, **207***c* and **207***d*, with which the middle frame **208** is provided. The bottom portion **150**D rotatably supports one of the lengthwise end of the first support roller **103**, and the corresponding lengthwise end of the second support roller **104**, by its holding frame **206***a*. Further, it rotatably supports the other lengthwise end of the first support roller **103**, and the corresponding lengthwise end of the second support roller **104**, by its holding frame **206***b*.

Referring to FIG. **14**, the bottom portion **150**D rotationally moves the holding frames **206***a* and **206***b* relative to each other in such a manner that the combination of the holding frames **206***a* and **206***b* is twisted at the center of the combination in terms of the lengthwise direction of the combination. As the holding frames **206***a* and **206***b* are rotationally moved relative to each other, the first and second support rollers **103** and **104** become angled relative to each other. Consequently, the nip between the external heat belt **105** and fixation roller **101** autonomously becomes roughly uniform in its internal pressure, in terms of the lengthwise direction of the external heat belt **105**.

Referring to FIG. **13**, the holding frames **206***a* and **206***b* have regulating portions **300**A and **300**B which limit the angle by which the holding frames **206***a* and **206***b* are allowed to be rotationally moved relative to each other to limit the angle (amount of displacement) by which the first and second support rollers **103** and **104** are allowed to rotationally move relative to each other.

Referring to FIG. **15**, the holding frame **206***a* has two bent portions **301***a* and **301***b*, each of which was formed by bending a part of the holding frame **206***a* at two positions. In terms of the lengthwise direction of the bottom portion **150**D, the bent portions **301***a* and **301***b* are at the center of the **150**D. In terms of the widthwise direction of the **150**D, the bent portions **301***a* and **301***b* are at the widthwise ends of the **150**D, one for one. Further, the bent portion **301***a* is on one side of the axle **207***b*, and the bent portion **301***b* is on the other side of the axle **207***b*. The holding frame **206***b* is provided with flat portions **302***a* and **302***b*, which protrude toward the holding frame **206***a* from the inward edge of the main portion of the holding frames **206***b*. The flat portion **302***a* is on one side of the axle **207***c*, and the flat portion **302***b* is on the other wide of the axle **207***c*. Regarding the regulating portion **300**A, its bent portion **301***a*, which is a part of the holding frame **206***a*, extends toward the holding frame **206***b*, far enough to reach the area above the flat portion **302***a* of the holding frame **206***b*, overlapping with the flat portion **302***a* of the holding frame **206***b* in terms of the lengthwise direction of the bottom portion **150**D. As for the regulating portion, the bent portion **301***b*, which is a part of the holding frame **206***a*, extends to the area above the flat portion **302***b* of the holding frame **206***b*, overlapping with the flat portion **302***b* in terms of the lengthwise direction of the bottom portion **150**D.

Referring to FIG. **16**(*a*), as the holding frame **206***b* rotationally moves relative to the holding frame **206***a* in the direction indicated by an arrow mark A, the flat portion **302***b* of the holding frame **206***b* comes into contact with the bent portion **301***b* of the holding frame **206***a*, preventing thereby holding frame **206***b* from rotationally moving further.

Referring to FIG. **16**(*b*), as the holding frame **206***b* rotationally moves relative to the holding frame **206***a* in the direction indicated by an arrow mark B, the flat portion **302***a* of the holding frame **206***b* comes into contact with the bent portion **301***a* of the holding frame **206***a*, preventing thereby holding frame **206***b* from rotationally moving further.

As described above, as the holding frame **206***b* rotationally moves relative to the holding frame **206***a*, the flat portions **302***a* and **302***b* of the holding frame **206***b* come into contact with the bent portions **301***a* and **301***b* of the holding frame **206***a*, respectively. Therefore, it does not occur that the angle between the first and second support rollers **103** and **104** becomes excessive.

(Rotational Angle of Holding Frames Relative to Each Other)

FIG. **17** is a schematic drawing for describing the angle by which the holding frames are allowed to rotationally move relative to each other. FIG. **18** is a schematic drawing for describing the range to which the angle by which the holding frames are allowed to be rotationally moved relative each other is limited. FIG. **19** is a schematic drawing for describing the effects of the first embodiment.

Referring to FIG. **17**(*a*), the angle by which the external heating unit **150** is rotationally moved about the axle **209** to change the angle between the generatrix of the fixation roller **101** and that of the external heat belt **105**, in order to control the lateral deviation of the external heat belt **105** in the direction parallel to the lengthwise direction of the first and second support rollers **103** and **104**. The angle α between the fixation roller **101** and external heat belt **105** is controlled according to the change in the speed of the lateral deviation of the external heat belt **105**, change in the distance of the lateral deviation of the external heat belt **105**, etc. The angle α is set to be no more than a certain numerical value. In a case where the lateral deviation of the external heat belt **105** cannot be controlled even if the angle α is set to the maximum value, it is determined that something is wrong with the external heating unit **150**. Then, an error message is displayed. In the first embodiment, the maximum value α_x for the angle α is set to 2°.

Referring to FIG. **17**(*b*), as the angle α between the external heat belt **105** and fixation roller **101** is changed, the first and second support rollers **103** and **104** by which the external heat belt **105** is suspended and kept stretched are rotationally moved relative to each other. That is, they are slanted (angled) relative to each other. As a result, the holding frames **206***a* and **206***b* are rotationally moved (twisted) relative to each other, and therefore, they become slanted relative each other by an angle β. In this embodiment, the maximum value β_{max}, for the angle that is, the maximum angle by which the holding frames **206***a* and **206***b* are rotationally movable relative to each other when the angle α between the generatrix of the fixation roller **101** and that of the external heat belt **105** is the maximum value α_{max}, is set to 6°. Referring to FIG. **18**, the angle γ between the holding frames **206***a* and **206***b* when the bent portion **301***b* of the holding frame **206***a* is in contact with the flat portion **302***b* of the holding frame **206***b*, that is, when the holding frame **206***a* and **206***b* are in their positions which do not allowed to rotationally move further relative to each other, is set so that the relation between the angle γ and maximum value β_{max} satisfies the following mathematical formula:

$$\gamma \geq \beta_{max}.$$

The angle γ is affected by the component tolerance. Therefore, the external heating unit **150** is desired to be designed so that the angle γ becomes greater than the maximum value β_{max} ($\gamma > \beta_{max}$). If the angel γ is no more than the maximum value β_{max} the first and second support rollers **103** and **104** are insufficiently slanted relative to each other, and therefore, the nip between the external heat belt **105** and fixation roller **101** becomes nonuniform in the internal pressure in terms of the lengthwise direction of the fixation roller **101**.

In the first embodiment, the angle γ was set to 8° which is greater than the maximum vale β_{max}, which was 6°. Therefore, it does not occur that when the lateral deviation of the external heat belt **105** is controlled, the nip between the external heat belt **105** and fixation roller **101** is affected in the distribution of its internal pressure in terms of the lengthwise direction of the fixation roller **101**. Further, it does not occur that the when the external heating unit **150** is assembled, and/or when the external heating unit **150** is lifted, the first and second support rollers **103** and **104**, by which the external heat belt **105** is suspended and kept stretched, are excessively slanted relative to each other.

Referring to FIG. **19**(*a*), in the case of the first comparative external heating unit (**150**), the distance between the external heat belt **105** and thermistor **123***a* is changed by the slanting of the first support roller **103** relative to the second support roller **104** is substantial. Therefore, it is possible that the leaf spring **123***m* will be permanently deformed. Referring to FIG. **19**(*b*), in the first embodiment, however, the external heating unit (**150**) is regulated so that the change which occurs to the distance between the external heat belt **105** and thermistor **123***a* as the first support roller **103** is slanted relative to the second support roller **104** remains relatively small. Therefore, it does not occur that the leaf spring **123***m* is permanently deformed. The first embodiment ensures that when the angle θ between the fixation roller **101** and external heat belt **105** is changed to control the external heat belt **105** in lateral deviation, the holding frames **206***a* and **206***b* are allowed to rotationally move relative to each other by an angle which is satisfactory to keep the nip between the external heat belt **105** and fixation roller **101** uniform in internal pressure in terms of the lengthwise direction of the external heat belt **105**. That is, the nip between the external heat belt **105** and fixation roller **101** is not affected in the distribution of its internal pressure, in terms of the lengthwise direction of the external heat belt **105**, by the controlling of the lateral deviation of the external heat belt **105**. In addition, the first embodiment regulates the angle by the holding frames **206***a* and **206***b* are slanted relative to each other, in order to keep within a tolerable range, the angle by which the first and second supporting rollers **103** and **104** are slanted relative to each other to control the lateral deviation of the external heat belt **105**. Therefore, it can reduce the distance by which the leaf spring **123***m* is displaced.

Further, according to the first embodiment, it does not occur that when the external heat belt **105** is replaced, and/or when the external heating unit **150** is individually lifted, the first and second support rollers **103** and **104** become excessively slanted relative to each other.

In the first embodiment, the external heating unit **150** is provided with the axle **209**, in order to change the angle between the external heating unit **150** and fixation roller **101** to control the lateral deviation of the external heat belt **105**. Further, the external heating unit **150** is structured so that the holding frame **206***a* which holds the first support roller **103** by the lengthwise ends of the roller **103**, and the holding frame **206***b* which holds the second support roller **104** by the lengthwise ends of the roller **104**, are allowed to be slanted relative to each other.

However, the angle by which the holding frames **206***a* and **206***b* are allowed to be slanted relative to each other is made to be greater than the maximum angle by which the first and second support rollers **103** and **104** are allowed to be slanted relative to each other to control the lateral deviation of the external heat belt **105**. Therefore, it is possible to regulate the distance by which the thermistor **123***m*, which is placed in contact with the surface of the external heat belt **105** to detect the surface temperature of the external heat belt **105**, is displaced, without causing the slanting of the holding frames **206***a* and **206***b* relative to each other to affect the controlling of the lateral deviation of the external heat belt **105**. Therefore, it does not occur that when the external heating unit **150** is assembled, the first and second support rollers **103** and **104** are excessively slanted relative to each other. Therefore, it does not occur that when the external heating unit **150** is assembled, the thermistor **123***a*, which is to remain in contact with the surface of the external heat belt **105** to detect the surface temperature of the external heat belt **105** is displaced by an undesirably large distance.

Embodiment 2

FIG. **20** is a schematic drawing for describing the positioning of the regulating portion of the external heating unit in the second embodiment of the present invention. FIG. **21** is a schematic drawing for describing the positioning of the thermistors in the second embodiment. FIG. **22** is a schematic drawing for describing the structural arrangement, in the second embodiment, for controlling the rotational movement of the sensor supporting axle relative to the holding frame. FIG. **23** is a schematic drawing for describing the rotationally movement of the holding frames relative to each other, which is caused to slant the frames relative to each other. FIG. **24** is a schematic drawing for describing the operation of the regulating portion in the second embodiment. Referring to FIG. **21**, the sensor supporting shaft **303**, which is an example of a beam supportable by both of its lengthwise ends, is disposed between the holding frames **206***a* and **206***b* in such a manner that it bridges between the holding frames **206***a* and **206***b*. As the holding frames **206***a* and **206***b* are rotationally moved relative to each other in the direction parallel to the recording medium conveyance direction, the first and second support rollers **103** and **104** are slanted (angled) relative to each other in the direction parallel to the recording medium conveyance direction.

Referring to FIG. **12**, in the first embodiment, as the holding frames **206***a* and **206***b* are rotationally moved relative to each other, the distance between the horizontal portion of the holding frame **206***a*, and the peripheral surface of the first support roller **103** substantially changes. Therefore, it is necessary that the leaf spring **123***m* fixed to the horizontal portion of the holding frame **206***a*, by its base portion, substantially deforms to tolerate the large amount of displacement of the thermistor **123***m*.

Referring to FIG. **20**, in the second embodiment, as the holding frames **206***a* and **206***b* are rotationally moved relative to each other, the base portion of the leaf spring **123***m* is allowed to move upward or downward to reduce the distance by which the thermistor **123***m* is moved relative to the base portion of the leaf spring **123***m*. Therefore, the range in which the distance between the thermistor **123***a* and the peripheral surface of the first support roller **103**, and the distance between the thermistor **123***b* and the peripheral surface of the first support roller **103**, are allowed to change as the first and second support rollers **103** and **104** are angled relative to each other, is relatively small.

Referring to FIG. **20**, in the second embodiment, the sensor supporting shaft **303** is disposed between the holding frames **206***a* and **206***b*, in parallel to the first support roller **103**. Further, the sensor supporting shaft **304** is disposed between the holding frames **206***a* and **206***b*, in parallel to the second support roller **104**. Further, the thermistors **123***a* and **123***b* are supported by the sensor supporting shaft **303**, and the thermistors **124***a* and **124***b* are supported by the sensor supporting shaft **304**.

One of the lengthwise ends of the first support roller **103**, and the corresponding lengthwise end of the second support roller **104**, are rotatably supported by the holding frame **206***a*, which is rotatably supported by the axle **207***a* attached to the middle frame **208**. The opposite lengthwise end of the first support roller **103** from the lengthwise end supported by the holding frame **206***a*, and the corresponding lengthwise end of the second support roller **104**, are rotatably supported by the holding frame **206***b*, which is rotatably supported by the axle **207***b* attached to the middle frame **208**.

Referring to FIG. **21**, the sensor supporting shafts **303** and **304** are put through the holding frames **206***a* and **20***b* in such a manner that they bridge between the holding frames **206***a* and **206***b*. The leaf springs **123***m* and **123***n* are fixed to the sensor supporting shaft **303**, by their base portions. The thermistors **123***a* and **123***b* are fixed to the tips of the leaf springs **123***m* and **123***n*, respectively. The leaf springs **124***m* and **124***n* are fixed to the sensor supporting shaft **304**, by their base portions. The thermistors **124***a* and **124***b* are fixed to the tips of the leaf springs **124***m* and **124***n*, respectively.

Referring to FIG. **22**, the lengthwise end portion of the sensor supporting shaft **303**, and the lengthwise end portion of the sensor supporting shaft **304**, which are to be put through the holding frame **206***a*, are shaped so that they appear like a letter D in cross-section. That is, the sensor supporting shafts **303** and **304** are prevented from rotating relative to the holding frame **206***a*, while being allowed to rotate relative to the holding frame **206***b*. Further, after the sensor supporting shafts **303** and **304** are put through the holding frames **206***a* and **206***b*, the portions of the sensor supporting shafts **303** and **304**, which are on the outward side of the holding frames **206***a* and **206***b*, are fitted with a locking ring **305** which is for preventing the shafts **303** and **304** from disengaging from the holding frames **206***a* and **206***b*.

Referring to FIG. **23**(*a*), as the holding frame **206***a* and **206***b* are rotationally moved relative to each other by the controlling of the lateral deviation of the external heat belt **105**, the first and second support rollers **103** and **104** are slanted relative to each other, and at the same time, the sensor supporting shafts **303** and **304** are also slanted relative to each other. Therefore, the first and second support rollers **103** and **104** remain roughly parallel to the sensor supporting shafts **303** and **304**, respectively. Thus, this embodiment is smaller than the first embodiment, in the amount of the change in the distance between the thermistor **123***a* and the first support roller **103**, and the distance between the thermistor **123***b* and first support roller **103**, which is caused by the rotational movement of the holding frames **206***a* and **206***b* relative to each other, and also, in the amount of change in the distance between the thermistor **124***a* and second support roller **104**, and also, the amount of change in the distance between the thermistor **124***b* and second support roller **104**.

Referring to FIGS. **23**(*b*) and **23**(*c*), therefore, when the first and second support rollers **103** and **104** are slanted relative to each other, the sensor supporting shafts **303** and **304** remain in parallel to the first and second support rollers **103** and **104**, respectively. Further, the sensor supporting shafts **303** and **304** are prevented by the locking rings **305** from disengaging from the holding frames **206***a* and **206***b*, because the direction in which the sensor supporting shaft **303** is slanted is the same as the direction in which first support roller **103** is slanted relative to the second support roller **104**, and the direction in which the sensor supporting shaft **304** is slanted is the same as the direction in which the second support roller **104** is slanted relative to the first support roller **103**.

Therefore, this embodiment is smaller than the first embodiment, in the change, in position, of the areas of contact between the thermistors **123***a* and **123***b* attached to the leaf springs **123***m* and **123***n*, respectively, attached to the sensor supporting shaft **303**, and the first support roller **103**, and also, in the change, in position, of the areas of contact between the thermistors **124***a* and **124***b* attached to the leaf springs **124***m* and **124***n*, respectively, attached to the sensor supporting shaft **304**, and the second support shaft **104**. In the second embodiment, therefore, the leaf springs **123***m*, **123***n*, **124***m* and **124***n* are less likely to be permanently deformed by the controlling of the lateral deviation of the external heat belt **105**, than in the first embodiment.

However, also in the case of the second embodiment, it is possible that when the external heating unit **150** is assembled, and/or when the external heating unit **150** is independently lifted from the other components of a fixing device, the first and second support rollers **103** and **104** will be slanted relative to each other by an angle large enough to cause the leaf spring **123***m* to be permanently deformed.

Referring to FIG. **20**, in this embodiment, therefore, the front side of the middle frame **208** is provided with a pair of flat portions **305***a* and **305***b* to limit the angle by which the holding frame **206***a* is allowed to rotationally move. Further, the rear side of the middle frame **208** is provided with a pair of flat portions **306***a* and **306***b* to limit the angle by which the holding frame **206***b* is allowed to rotationally move.

Referring to FIG. **24**, on the front side, as the holding frame **206***a* is rotationally moved relative to the middle frame **208**, the holding frame **206***a* comes into contact with the flat portion **305***a* or **305***b* fixed to the middle frame **208**. Therefore, the angle by which the holding frame **206***a* is allowed to rotationally move relative to the middle frame **208** is regulated to be in a preset range. On the rear side, as the holding frame **206***b* is rotationally moved relative to the middle frame **208**, the holding frame **206***b* comes into contact with the flat portion **306***a* or **306***b* fixed to the middle frame **208**. Therefore, the angle by which the holding frame **206***b* is allowed to rotationally move relative to the middle frame **208** is regulated to be in a preset range. The preset ranges for the angles by which the holding frames **206***a* and **206***b* are allowed to rotationally move relative to the middle frame **208** may be the same as those in the first embodiment. That is, they may be set to be slightly wider than the angle by which the first and second support roller **103** and **104** are allowed to be slanted relative to each other to control the external heat belt **105** in lateral deviation, in order not to interfere with the controlling of the lateral deviation of the external heat belt **105**. Although FIG. **24** shows only the structure of the holding frame **206***a* and its adjacencies, the holding frame **206***b* and its adjacencies are similar in structure to the holding frame **206***a* and its adjacencies.

The second embodiment is smaller than the first embodiment, in the distance by which the thermistors **123***a*, **123***b*, **124***a* and **124***b* are displaced. Therefore, it is higher than the first embodiment, in the repeatability with which the surface temperature of the external heat belt **105** (first and second support rollers **103** and **104**) is accurately detected. On the other hand, in the second embodiment, the rotational movement of the external heating unit **150** is significantly controlled by the presence of the sensor supporting shafts **303** and **304**. Therefore, it is significantly smaller than the first embodiment, in the amount of the temperature detection error attributable to the permanent deformation of the leaf springs **123***m*, **123***n*, **124***m* and/or **124***n*.

Embodiment 3

FIG. **25** is a schematic drawing for describing the regulating portion in the third embodiment of the present invention. Referring to FIG. **25**, the number of the areas of the external heating unit **150** to which the mechanism for limiting the angle by which the first and second holding frames are allowed to be slanted relative to each other is attached may be only one. Otherwise, the external heating unit in the third embodiment is similar in structure to the external heating unit **150** in first embodiment.

As will be evident from the foregoing description of the first to third embodiment, the present invention encompasses various image heating apparatuses other than those in the preceding embodiments of the present invention, as long as they are structured so that the angle by which their first and second holding portions are allowed to be slanted relative to each other is limited to be in a preset range, whether they are partially or entirely different in structure from those in the preceding embodiments.

That is, the means for heating a rotational heating member, an endless heating belt (belt supporting members, as well), and the like, does not need to be limited to a halogen heater. For example, a rotational heating member, an endless heating belt, and the like may be provided with a heating layer in which heat can be inductively generated by an alternating magnetic flux. Further, a rotational heating member does not need to be limited to a fixation roller. For example, it may be a pressure roller capable of heating the opposite surface of a sheet of recording medium from the surface having an image.

Further, an image heating apparatus to which the present invention is applicable is not limited to a fixing device such as those in the preceding embodiments. That is, the present invention is also applicable to a surface heating apparatus (device) for altering a temporarily fixed image or a permanent fixed image in surface properties such as glossiness.

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

This application claims priority from Japanese Patent Application No. 025457/2013 filed Feb. 13, 2013, which is hereby incorporated by reference.

What is claimed is:

1. An image heating apparatus comprising:

a rotatable heating member configured to heat a toner image on a recording material;

a belt unit including an endless belt configured and positioned to contact said rotatable heating member to heat said rotatable heating member, and first and second supporting members rotatably supporting an inner surface of said belt and configured to urge said belt to said rotatable heating member;

a detector configured and positioned to detect that said belt is deviated from a predetermined zone with respect to a widthwise direction said belt;

a rotating mechanism configured to rotate said belt unit in a direction for returning said belt into the predetermined zone on a basis of an output of said detector;

a displacing mechanism configured to permit said first supporting member to be displaced, with rotation of said belt unit by said rotating mechanism, in a direction for substantially equalizing forces, from said first supporting member, urging said belt toward said rotatable heating member at opposite end portions of said first supporting member with respect to the widthwise direction and to permit said second supporting member to be displaced, with the rotation of said belt unit by said rotating mechanism, in a direction for substantially equalizing forces, from said second supporting member, urging said belt toward said rotatable heating member at opposite end portions of said second supporting member with respect to the widthwise direction; and

a restricting mechanism configured to restrict displacement of said first supporting member beyond a first predetermined position and to restrict displacement of said second supporting member beyond a second predetermined position,

wherein the first predetermined position is outside an area in which said first supporting member is displaceable with the rotation of said belt unit by said rotating mechanism, and the second predetermined position is outside an area in which said second supporting member is displaceable with the rotation of said belt unit by said rotating mechanism.

2. An apparatus according to claim **1**, wherein said restricting mechanism includes a stopper configured to be abutted by said displacing mechanism so that the displacement of the first supporting member beyond the first predetermined position is restricted and so that the displacement of the second supporting member beyond the second predetermined position is restricted, when said belt unit, said displacing mechanism and said restricting mechanism are integrally dismounted from said apparatus.

3. An apparatus according to claim **2**, wherein said displacing mechanism includes:

a first holding member which holds said one end portions of said first and second supporting members and which is swingable around a first axis, with rotation of said belt unit by said rotating mechanism, in directions for substantially equalizing the forces, from said first and second supporting members, urging said belt toward said rotatable heating member at said one end portions; and

a second holding member which holds said other end portions of said first and second supporting members and which is swingable around a second axis, with the rotation of said belt unit by said rotating mechanism, in directions for substantially equalizing the forces, from said first and second supporting members, urging said belt toward said rotatable heating member at other one end portions,

wherein said stopper is configured to be abutted by said first holding member so that tilting of said first holding member in a circumferential direction about the first axis beyond a predetermined angle is restricted, when said belt unit, said displacing mechanism and said restricting mechanism are integrally dismounted from said the apparatus.

4. An apparatus according to claim **3**, wherein said first axis and said second axis are a common axis, wherein said stopper bridges between said first holding member and said second holding member at the position which is outside of said belt and which is different from the common axis.

5. An apparatus according to claim **3**, wherein

when said first holding member tilts in one circumferential direction about the first axis, said second holding member is tilted in the other circumferential direction about said second axis, and wherein said first holding member tilts in the other circumferential direction about the first axis, said second holding member is tilted in said one circumferential direction about said second axis, with rotation of said belt unit by said rotating mechanism, and

said restricting mechanism further includes an additional stopper configured to be abutted by said second holding member so that tilting of said second holding member in said one circumferential direction about the second axis beyond an additional predetermined angle is restricted, when said belt unit, said displacing mechanism and said restricting mechanism are integrally dismounted from said the apparatus.

6. An apparatus according to claim 3, further comprising:

a first temperature detecting member configured and positioned to detect a temperature of said belt;

a first urging member having one end portion fixed to said first holding member and the other end portion supporting said first temperature detecting member, and configured and positioned to urge said first temperature detecting member in a direction for sandwiching said belt between itself and said first supporting member;

a second temperature detecting member configured and positioned to detect a temperature of said belt; and

a second urging member having one end portion fixed to said second holding member and the other end portion supporting said second temperature detecting member, and configured and positioned to urge said second temperature detecting member in a direction for sandwiching said belt between itself and said second supporting member.

7. An apparatus according to claim 1, further comprising a temperature detecting member configured and positioned to detect a temperature of said belt, and an urging member having one end portion fixed to said displacing mechanism and the other end portion supporting said temperature detecting member and configured and positioned to urge said temperature detecting member in a direction for sandwiching said belt between itself and said first supporting member.

8. An apparatus according to claim 7, further comprising another temperature detecting member configured and positioned to detect a temperature of said belt, and another urging member having one end portion fixed to said displacing mechanism and the other end portion supporting said temperature detecting member and configured and positioned to urge said another temperature detecting member in a direction for sandwiching said belt between itself and said second supporting member.

9. An apparatus according to claim 1, further comprising a driving mechanism configured to rotate said rotatable heating member, wherein said belt is rotated by said rotatable heating member.

10. An apparatus according to claim 1, wherein said first and second supporting member are provided with respective heaters.

11. An apparatus according to claim 1, wherein said belt unit, said displacing mechanism and said restricting mechanism are integrally dismountable from said apparatus.

12. An image heating apparatus comprising:

a rotatable heating member configured to heat a toner image on a recording material;

a belt unit including an endless belt configured and positioned to contact said rotatable heating member to heat said rotatable heating member, and first and second supporting rollers rotatably supporting an inner surface of said belt and configured to urge said belt to said rotatable heating member;

a detector configured and positioned to detect that said belt is deviated from a predetermined zone with respect to a widthwise direction said belt;

a rotating mechanism configured to rotate said belt unit in a direction for returning said belt into the predetermined zone on the basis of an output of said detector;

a displacing mechanism configured to permit said first and second supporting rollers to be displaced, with rotation of said belt unit by said rotating mechanism, into a positional relation in which axes of said first and second supporting rollers are skewed relative to each other; and

a restricting mechanism configured to restrict displacement of said first supporting roller beyond a first predetermined position and to restrict displacement of said second supporting roller beyond a predetermined position,

wherein the first predetermined position is outside an area in which said first supporting roller is displaceable with the rotation of said belt unit by said rotating mechanism, and the second predetermined position is outside an area in which said second supporting roller is displaceable with the rotation of said belt unit by said rotating mechanism.

13. An apparatus according to claim 12, wherein said restricting mechanism includes a stopper configured to be abutted by said displacing mechanism so that the displacement of the first supporting roller beyond the first predetermined position is restricted and so that the displacement of the second supporting roller beyond the second predetermined position is restricted, when said belt unit, said displacing mechanism and said restricting mechanism are integrally dismounted from said apparatus.

14. An apparatus according to claim 13, wherein said displacing mechanism includes:

a first holding member which holds said one end portions of said first and second supporting rollers and which is swingable around a first axis, with rotation of said belt unit by said rotating mechanism, in directions for substantially equalizing the forces, from said first and second supporting rollers, urging said belt toward said rotatable heating member at said one end portions; and

a second holding member which holds said other end portions of said first and second supporting rollers and which is swingable around a second axis, with the rotation of said belt unit by said rotating mechanism, in directions for substantially equalizing the forces, from said first and second supporting rollers, urging said belt toward said rotatable heating member at other one end portions,

wherein said stopper is configured to be abutted by said first holding member so that tilting of said first holding member in a circumferential direction about the first axis beyond a predetermined angle is restricted, when said belt unit, said displacing mechanism and said restricting mechanism are integrally dismounted from said the apparatus.

15. An apparatus according to claim 14, wherein said first axis and said second axis are a common axis, and

wherein said stopper bridges between said first holding member and said second holding member at the position which is outside of said belt and which is different from the common axis.

16. An apparatus according to claim 14, wherein

when said first holding member tilts in one circumferential direction about the first axis, said second holding member is tilted in the other circumferential direction about said second axis, and wherein said first holding member tilts in the other circumferential direction about the first axis, said second holding member is tilted in said one circumferential direction about said second axis, with rotation of said belt unit by said rotating mechanism, and

said restricting mechanism further includes an additional stopper configured to be abutted by said second holding member so that tilting of said second holding member in said one circumferential direction about the second axis beyond an additional predetermined angle is restricted, when said belt unit, said displacing mechanism and said restricting mechanism are integrally dismounted from said the apparatus.

17. An apparatus according to claim 14, further comprising:

a first temperature detecting member configured and positioned to detect a temperature of said belt;

a first urging member having one end portion fixed to said first holding member and the other end portion supporting said first temperature detecting member, and configured and positioned to urge said first temperature detecting member in a direction for sandwiching said belt between itself and said first supporting roller;

a second temperature detecting member configured and positioned to detect a temperature of said belt; and

a second urging member having one end portion fixed to said second holding member and the other end portion supporting said second temperature detecting member, and configured and positioned to urge said second temperature detecting member in a direction for sandwiching said belt between itself and said second supporting roller.

18. An apparatus according to claim 12, further comprising a temperature detecting member configured and positioned to detect a temperature of said belt, and an urging member having one end portion fixed to said displacing mechanism and the other end portion supporting said temperature detecting member and configured and positioned to urge said temperature detecting member in a direction for sandwiching said belt between itself and said first supporting roller.

19. An apparatus according to claim 18, further comprising another temperature detecting member configured and positioned to detect a temperature of said belt, and another urging member having one end portion fixed to said displacing mechanism and the other end portion supporting said temperature detecting member and configured and positioned to urge said another temperature detecting member in a direction for sandwiching said belt between itself and said second supporting roller.

20. An apparatus according to claim 12, further comprising a driving mechanism configured to rotate said rotatable heating member, wherein said belt is rotated by said rotatable heating member.

21. An apparatus according to claim 12, wherein said first and second supporting rollers are provided with respective heaters.

22. An apparatus according to claim 12, wherein said belt unit, said displacing mechanism and said restricting mechanism are integrally dismountable from said apparatus.

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